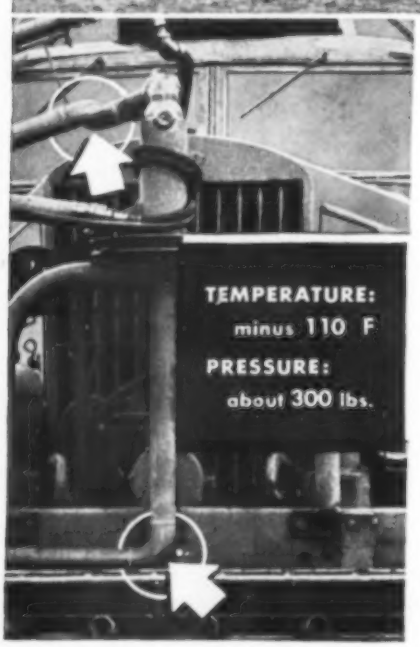
CHEMICAL
& Metallurgical
ENGINEERING

For AUGUST, 1945 • CHEMICALS FROM NATURAL GAS AT TEXAS PLANT • MAGNESIUM PLANT TURNS OUT METALLIC CALCIUM • SCIENCE ACHIEVES OFFICIAL RECOGNITION • AMERICAN INDUSTRY FORECASTS FIRST POSTWAR YEAR • WASTE, AN IMPORTANT FACTOR IN INDUSTRY PLANNING • GRAPHICAL ANALYSES FOR NEW PROCESSES

Fractionating towers in a unit of the new Texas chemical plant of Celanese

"SNOW" *fights airplane fires*



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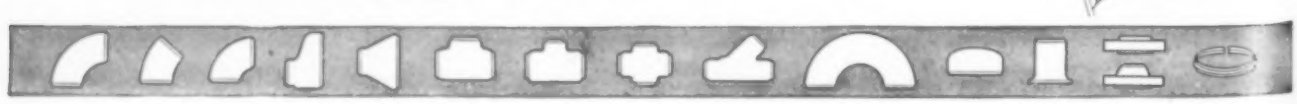

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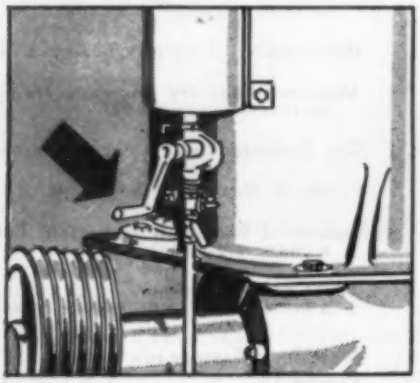

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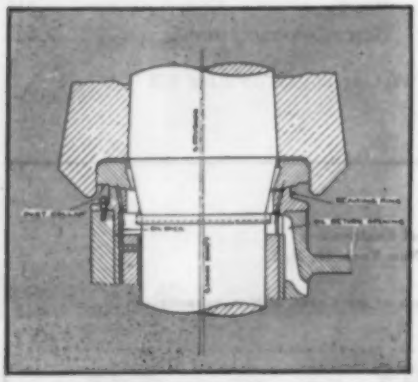

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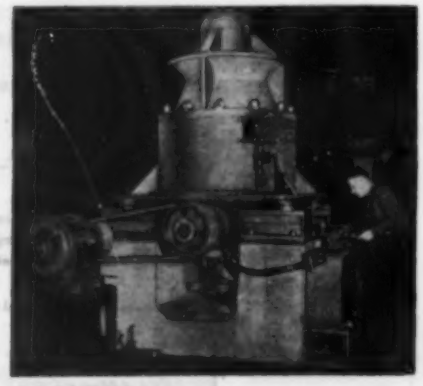

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CHEMICAL
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ENGINEERING

ESTABLISHED 1902 — S. D. KIRKPATRICK, Editor

AUGUST 1945

Industry Charts Its Postwar Future

NOW that we are approaching our first full postwar year after reconversion, what can we expect will be the volume of industrial production? How large will be the national labor force and how fully will it be employed? Which of the chemical and process industries face the best prospects and where will they find their markets? These and many other questions are answered authoritatively in a recent and remarkable report by the marketing committee of the Committee for Economic Development, entitled "American Industry Looks Ahead." To read it and study its implications is a thrilling experience that should bring courage and hope to every engineer and executive who thinks of his own future in terms of that of private enterprise.

The Committee for Economic Development, or "CED," was organized late in 1942 as a non-profit, non-political association of businessmen. Its sole purpose has been to promote a high level of business activity as the best means of avoiding mass unemployment after the war. It holds that 30 to 45 percent more business volume than in 1940 would provide 7 to 10 million more jobs. This would not only prevent mass employment by government, and thereby ease the tax burden, but such a prosperous business would provide the greater revenues needed for the postwar economy.

The CED Research Division was organized to help determine what policies of government, business, labor and agriculture will best contribute to that expanding economy. Its primary purpose is to undertake special studies designed to help businessmen in their efforts to plan for postwar progress in their own enterprises and to contribute to the broader objective of achieving a sound and stable "economic climate" favorable to business activity and job expansion.

Thus, it is only natural that CED should look to American industry itself to make a comprehensive forecast of its markets for the postwar year 1947. It felt that the people best qualified to do this difficult job were those most familiar with the situations and problems involved—the manufacturers themselves. These men best know their own industries and over the years have successfully coped with their problems. Regardless of how good or how bad their estimates may be, either when viewed as a whole or on an industry-by-industry basis, they do constitute industry's own ideas as to what will occur after the war. As such they are of value as a working tool for those who must think, plan and act for the whole economy.

As will be noted in greater detail in our summary of the CED report on pages 108 to 110 of this issue, the process industries are among those for which the sharpest gains are predicted. Chemicals and allied products show an estimated increase for 1947 over 1939 of 58.2 percent—one of the highest for the broader census classifications. Plastics up 161.6 percent, rayon and allied products up 132.9 percent, compressed and liquefied gases up 117.4 percent, chemicals, n.e.c. (including synthetic rubber) up 76.4 percent—these are typical and such as to suggest a rather rosy picture of what's ahead in the fields of chemical engineering.

Yet, as the report repeatedly warned, any business man will make a great mistake if he blindly assumes that this high level of business activity is sure to materialize. He must continue to make up his own mind and lay out his own plans, just as he always has done. But in so doing, he should give full weight to the considered opinions of his fellow business men, because 1947 cannot be the good year this study envisions unless America's businessmen do their part. If all continue to hold their sights high, to plan boldly and realistically for more production of new and better products, marketed with maximum efficiency and effectiveness, the future can be even better than this report's most optimistic estimates.

P. H. STAUB *New England Lime Co., Canaan, Conn.*

CALCIUM

Produced by Ferrosilicon Process

Adaptation of the Pidgeon process has brought about a substantial increase in the world output of calcium metal. Wartime needs, together with available facilities, stimulated this activity in which magnesium retorts are used in the reduction of lime with aluminum to produce metallic calcium of high purity. While production methods appear to be on a sound technological and economic basis, only postwar market requirements will determine the future of this industry.—*Editors*

VOLUME production of high-purity calcium metal by thermal reduction of calcium oxide under vacuum is one of the interesting wartime developments in metallurgical processes. While the basic principles involved have been known for many years, practical commercial operation was first developed at the Defense Plant Corp.'s magnesium unit located in Canaan, Conn., operated by the New England Lime Co.

The location of this plant was chosen because of the existence of dolomite deposits of high-purity and low alkali metal content. Other quarries of the New England Lime Co. at Adams, Mass., consist of deposits of high-calcium limestone low in both magnesium and alkali metals.

Initial experiments on the production of calcium metal were undertaken largely as a matter of academic interest. Since the time and efforts of the entire staff had been and still were devoted to magnesium production, very little preliminary knowledge was available for guidance. It was known only that the reduction of alkaline earth oxides with aluminum had been proposed by several workers and that the temperature-vapor pressure curve for calcium and the thermal balance of probable reactions indicated that metallic calcium might be produced under the conditions existing in the magnesium retorts.

While preliminary runs made in single retorts of magnesium furnaces were moderately successful, no further work was undertaken as magnesium was at that time still on the critical list and neither time nor facilities were available for further study of calcium. The opportunity for continuation of the work was presented with the cut-back in magnesium production early in the fall of 1944. In the meantime, inquiry had indicated that there might be a substantial demand in the metallurgical and chemical industries for high-purity calcium metal at the economic level made possible by this process. A limited program was laid out for experimental production.

In normal times the initiation and development of commercial production would doubtless have been slow. However, within a few weeks knowledge of this development reached the U. S. Army Signal Corps which was confronted with the necessity of obtaining large quantities of calcium hydride to be used as a portable source of hydrogen for the inflation of weather observation balloons. This demand, coupled with some production for industry in general, resulted in the conversion of a substantial portion of the plant from magnesium to calcium. The present output is believed to be well in excess of 1944 world production.

ALUMINUM USED

In this discussion of the process, doubtless much of the information set forth will be familiar to those who have knowledge of the Pidgeon process for the production of magnesium by the reduction of calcined dolomite with ferrosilicon under vacuum. However, any description which did not cover this ground would be of little interest to those not acquainted with magnesium production.

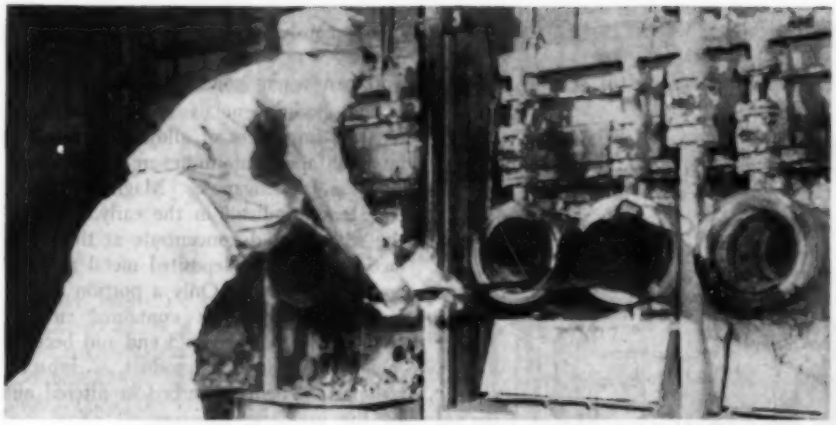
Primary material entering into the process is, of course, calcium oxide. A low cost product of adequate purity is obtained by calcining the natural limestone from the Adams quarries. A typical analysis of both the stone and the calcine are given in the accompanying table.

	Limestone, Percent	Calcine, Percent
Loss on ignition	43.71	0.50
CaO	55.19	97.55
SiO_2 and insolubles	0.40	0.70
Fe_2O_3, Al_2O_3	0.34	0.60
MgO	0.36	0.65
Na_2O, K_2O	0.005	0.009

Stone is calcined in rotary kilns at Adams and depending on operational convenience, is either ground there to approximately 60 percent—200 mesh in Raymond mills or shipped to Canaan as granular lime to be ground.

The reducing agent which has been found to be most satisfactory is aluminum powder of reasonably high purity. Fortunately, the bag-collector dust produced as a waste product in the preparation of aluminum powder by atomization of virgin aluminum has proven to be a source of material pure enough for general use and in adequate supply at an economic price level. This is typically, 96-99 percent aluminum, the principal impurities being iron and aluminum oxide. Atomized secondary metal may be used provided that

Calcium oxide is discharged from rotary kiln through this cooler



Reduction furnaces are charged manually with bags of briquettes

the lower boiling metals, notably magnesium or zinc, are not present in substantial amounts.

Calcined lime is stored in a bin from which it is discharged into a batch weigher. Aluminum is received in drums which are discharged through special funnel heads into a small hopper with a closed top to avoid dust explosions. This also discharges into the batch weigher hopper. From the weigh hopper the raw materials are discharged by gravity into vertical-shaft muller roll mixers. The mix is conveyed by means of a screw conveyor to a bucket elevator which discharges into a storage hopper over a Komarek-Greaves roll-type briquetting press. It is necessary to briquette without the aid of binding media, since the distillation of these would interfere with the establishment of vacuum later in the process and likewise, if of organic base, would react with the calcium metal to form calcium carbide. However, at pressures of 80 to 90 tons per sq. in. coherent briquettes of reasonable mechanical strength are secured.

NICKEL-CHROME RETORTS

For convenience in charging, and to secure some degree of protection from atmospheric humidity during the interval between briquetting and furnace charging, the briquettes are bagged in manila paper upon discharge from the press, and placed on carts for delivery to the furnaces.

The regenerative type automatic reversing furnaces are fired with producer gas having a heat value of about 150 B.t.u. per cu. ft. Each furnace contains 20 horizontal retorts of 15 percent Ni—28 percent Cr alloy 10 in. in diameter with a 1⅛-in. wall. Retorts are indirectly heated, a carborundum floor serving to prevent contact with combustion gases and avert unduly rapid oxidation. The hot zone of the retorts in which reduction and distillation take place is 8 ft. long. Extending through the wall of the furnace are the cold ends in which the metal is condensed. These are 2 ft. long and are of mild steel with a water jacket extending back 12 in. from the face. The water jacket provides cooling capacity for condensation of the metal from the vapor phase and also serves to protect the rubber gasket on the head plate which seals the retort.

For the purposes of the vacuum system, retorts are joined by headers into five banks of four retorts each. Each header is connected through 4-in. steel pipe with welded joints to a two stage vacuum pumping system. The first stage, known as the roughing line, is used to initially exhaust the retorts. Vacuum is provided by two mechanical pumps, each having a capacity of 100 cu.ft. per min. A glass cloth filter in the line between the headers and the pump serves to catch any briquette dust drawn into the system.

The second stage line is connected through a mercury diffusion pump to mechanical pumps having, likewise, a capacity of 100 cu.ft. per min. It is used to maintain low vacuum throughout the operation cycle after the initial evacuation. By means of suitable piping arrangement and valves, mechanical pumps may be used on either stage or as standbys. Each retort, each pump, and both lines may be isolated from the rest of the system by valves to permit removal for repairs or isolation of leaks.

Mechanical pumps are provided with an oil seal by means of a continuous supply of circulating oil. Oil from the return line is filtered through a bed of diatomaceous earth, passed through an electrically heated reclaimer to remove moisture, and returned to a storage tank for recirculation.

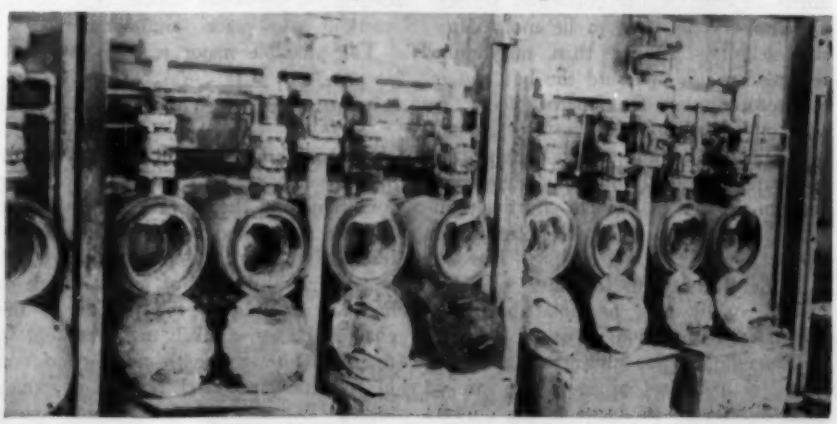
Returning to process operation, bagged briquettes are charged into the furnace retorts using a loading chute and charge bar. Removable condensers made of steel pipe 10 in. in diameter by 20 in. in length are placed in the cold end chamber. Next the "sodium-shields," which are baffle plates designed to effect selective condensation of low-boiling sodium and potassium, are placed in position toward the outer end of the condenser. As soon as the flame from the paper bags dies down, head plates are seated by first opening the retort valves on each bank and then the valves on the roughing line.

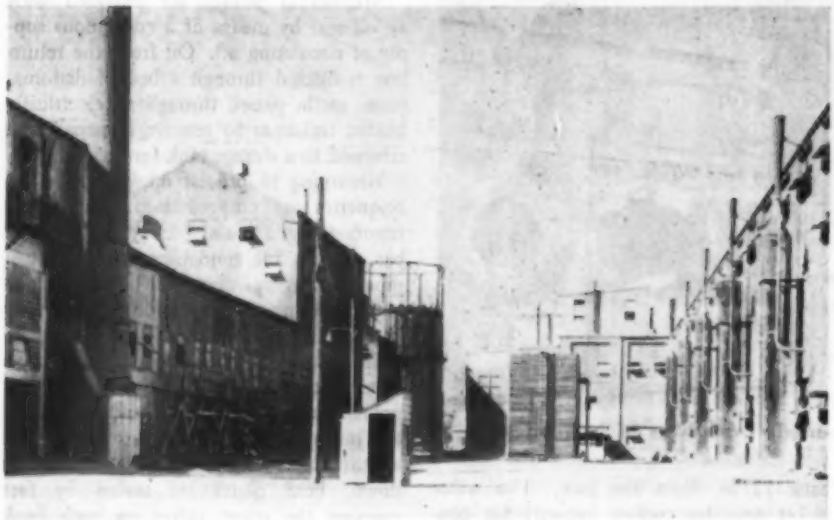
HIGH VACUUM

All retorts are drawn down to a pressure of about 400μ. This requires 1–2 hr. depending upon moisture content of the lime and residual CO_2. Slow draw-down is indicative of leaks in lines, head gaskets, or retorts which must be isolated and corrected. When the 400μ level is reached, the furnace is cut over on the second vacuum stage and pressures of 20μ or less should be obtained within 2½–3 hr. after the seating of the heads.

Roughing vacuums are determined periodically by means of a McLeod type mercury gage connected to the roughing line. Second stage vacuum is indicated once every 5 min. on each bank by an automatic recorder actuated by a thermocouple in the vacuum line. Leaks are immediately indicated and may be isolated and repaired. Failure to maintain vacuum results in low yields, poor apparent density of deposited metal and excessive formation of oxide and nitride. Furnace temperatures are controlled automatically, gas pressure being cut back as the temperature rises. Discharging of the furnace and

Flame at top of retorts is caused by burning off the paper bags which contain the lime-aluminum briquettes when charged to the furnace





View of furnace building on the right and calcining plant on the left

charging of the retorts drops the temperature of the furnace 100 to 150 deg. F. and 3–4 hr. are required to recover to a maximum of 2,200 deg. F. which is set not as a matter of reaction efficiency but rather as a maximum to avoid early retort collapse.

Calcium is liberated in the hot section of the retort and passes to the cold end by diffusion where it is condensed from the vapor to the solid phase. The operating cycle may vary from 8 to 24 hr. depending upon operating temperature, mix ratio, labor efficiency, and over-all cost considerations. At the end of the cycle the line valve is closed and vacuum in the retorts broken by means of a bleed valve in each header. Heads are removed; condensers drawn from the furnace with draw bars and piled on carts. The residue is drawn from the retorts with alloy scoops and dumped into hoppers beneath each retort which are, in turn, periodically discharged into dump trucks.

HIGH PURITY METAL

The metal, upon removal from the condensers, is in the form of hollow cylinders with one end closed. It consists of crystal masses grown from the nuclei of initial deposit on the condenser surface. Calcium crystals tend to be more dense and definitely formed than magnesium and tend to grow toward the hot end of the retort rather than perpendicular to the condenser surface. The cool crystals have a very thin film of oxide or nitride, apparently formed immediately when vacuum is broken, which effectively inhibits further oxidation or nitriding in contact with air during cooling. The film is irridescent, giving beautiful refractive colors, usually blue or violet but occasionally red or golden.

Depending upon ultimate consumption, the cylinders of metal are packed immediately for shipment or are crushed on a hydraulic press. With moderate heating, crystals may be extruded into bars which, while lacking structural strength, are convenient to handle in cutting exact weights of metal for alloying additions and to machine in producing turnings which are the preferred form for the chemical industries because of their high specific surface.

REACTION MECHANISM

The mechanism of the reaction is neither clearly defined nor well understood at the present time. Observation of furnace behavior indicates that the reaction is endothermic, but to a lesser degree than is the case with magnesium where

$$2\,(CaO\,MgO) + Si \longrightarrow 2\,Mg + 2\,CaO\,SiO^2$$
$$\Delta H = 638 \text{ kg. cal., or } 26.2 \text{ kg. cal. per g. Mg}$$

The residue contains unreacted aluminum, unliberated metallic calcium, and probably some unreacted lime in addition to true end products, making even an approximate analysis quite difficult. Neither laboratory manpower nor facilities have been available for any considerable study of residues nor of underlying principles of the reaction. From the limited amount of work done and from study of furnace efficiencies, it would appear that several reactions take place simultaneously.

The probable major reaction is

$$6\,CaO + 2\,Al \longrightarrow 3\,Ca + 3\,CaO\,Al_2O_3$$
$$\Delta H = 73.93 \text{ kg. cal. or } 0.62 \text{ kg cal. per g. Ca}$$

Control limits on the purity of raw materials are dictated by both operating conditions and the ultimate purity of the product as required by its end use. Moisture and residual CO_2 in the calcine delay the establishment of high vacuum as both are evolved in the heating of the charge. Excessive alkali metal content in the lime interferes with rapid deposition in the condenser and results in spongy metal. In addition, these metals ignite spontaneously when vacuum is broken at discharge resulting in some hazard to workmen where condensers are stuck.

Low boiling metals normally encountered as impurities or alloying ingredients in lime and aluminum are magnesium, zinc, and manganese. Magnesium and zinc tend to distill in the early stages of the reaction and concentrate at the interface between the deposited metal and the condenser surface. Only a portion of the lower boiling metals contained in the charge diffuse to the cold end and become incorporated in the product, a substantial portion being absorbed or filtered out by the briquette structure.

Oxide and nitride are, in general, concentrated in the initial deposit and also exist as a very thin film on the surface of the crystals. Metal made in a retort having a slight leak will have some nitride and oxide distributed throughout the mass, but these are readily detected by the appearance of the metal upon removal from the furnace.

A small amount of aluminum tends to distill over or is swept over as vapor along with calcium and is found in highest amount at the tip of the crystals. Other metals appear as spectrographic traces.

Due to the difficulty of obtaining truly representative samples, no accurate typical analysis of the calcium metal produced by this process can be given at this time. A statistical approach to typical analysis is being made, and while sufficient data to be conclusive are not yet available, it is believed that the following are approximate percentages: Calcium, 98–99; magnesium, 1.0 maximum; aluminum, .2 maximum; copper, .005–.01; lead, .005–.01; zinc, .005–.02; nickel, .005–.01; silicon, .005–.01; manganese, .005–.02; iron, .002–.005; cadmium, .0005–.001; chlorine, not present; nitrogen, .02 maximum; calcium hydroxide, dependent upon age and exposure of metal to atmospheric humidity —not subject to determination by analysis in fresh metal.

POSTWAR PROSPECTS

Calcium metal as now produced by this process appears to be of adequate purity for general purposes. By proper selection of raw materials and special care during processing, the major metallic impurities, magnesium and aluminum, could be sharply reduced should it become desirable to produce a higher purity metal for special purposes.

The economic future of the process will depend upon the adaptation of wartime uses to postwar industry; upon expanding use of calcium as an alloying ingredient and as a deoxidant, scavenger, and reducing agent in metallurgical processes; and upon appreciation and application of its inherent chemical activity to industrial chemical manufacturing operations.

CHEMICALS FROM NATURAL GAS AT TEXAS PLANT OF CELANESE

First large scale production of certain chemicals by a process using natural gases as raw material is now being done by Celanese Corp. of America at its new plant near Bishop, Tex., the initial unit of which has just started operations.

The principal chemicals being produced —acetic acid, acetic anhydride, acetone, methanol and formaldehyde—have been produced from petroleum raw materials in the past, but the Celanese process is new and results from ten years of research by chemists and chemical engineers in the company's organization. Acetic acid, acetic anhydride and acetone are vitally necessary in the synthesis which produces the textile and plastic products of the Celanese company.

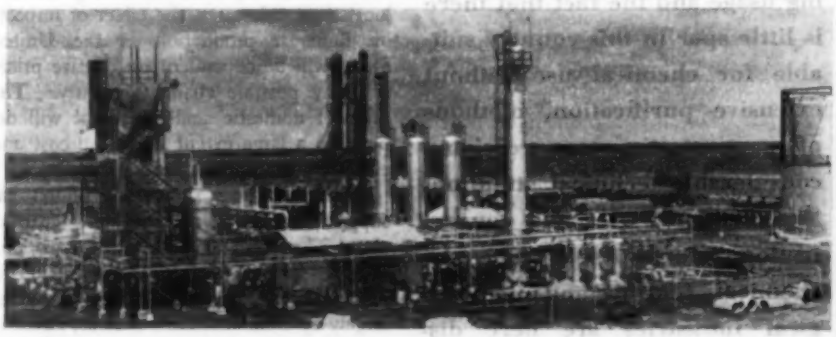
In addition to the chemicals now being produced it is expected that numerous other products will result from the activities at the Bishop plant. While the war is in progress Celanese will produce certain chemicals, such as hexamine, usable in the manufacture of high explosives as well as other materials with a strictly peacetime application.

A second unit of the chemical plant devoted exclusively to the manufacture of butadiene, is now about three-fourths completed and is expected to be in operation shortly. This unit was authorized by the Office of Rubber Director and the Rubber Reserve Co. to help in the government's synthetic rubber program following an extensive period of successful operation of a pilot plant at Cumberland, Md., for the manufacture of butadiene for synthetic rubber.

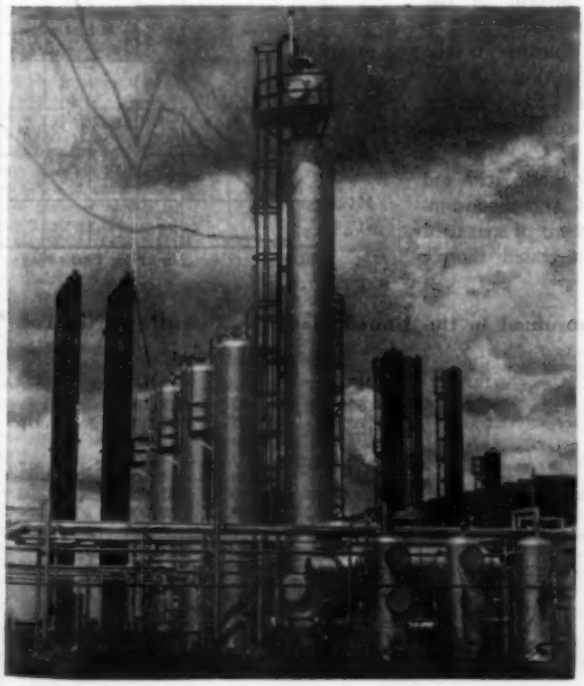
The new plant, situated a half-mile south of Bishop and about five miles north of Kingsville, has been under construction since November 1943. The site was chosen because of its abundance of petroleum and natural gas resources.

Expansion of the chemical manufacturing operations of Celanese is a natural outgrowth of the broadening business in the textile and plastics divisions. Originally the company was incorporated as the American Cellulose and Chemical Manufacturing Co. Ltd. to carry on a general chemical and manufacturing business.

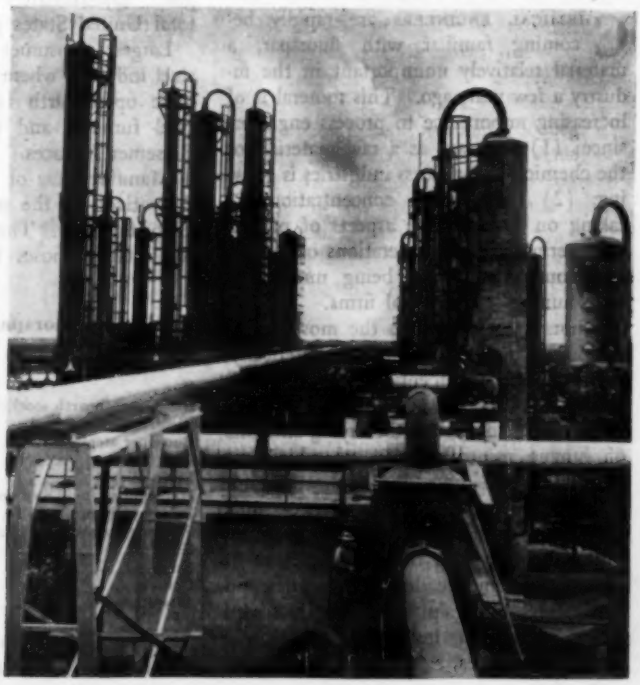
View of an uncompleted portion of the Celanese chemical plant in Texas—the butadiene producing section which, when operating, will add to the country's total source of supply of the main ingredient of buna-S rubber



Another view of part of the butadiene plant now under construction at the new Celanese Corp. of America's chemical plant at Chemcel, near Bishop



Fractionating towers in the Texas chemical plant of Celanese. Among the chemicals manufactured here are acetic acid and anhydride, formaldehyde and hexamine



HOWARD G. HYMER *Shrewsbury, N. J.*

FLUORSPAR

Raw Material for Process Industries

Fluorspar, rapidly becoming a major raw material for the chemical industry, is also widely used in the steel, glass, enamel, aluminum and other process industries. Because of its expanding usage and the fact that there is little spar in this country suitable for chemical use without extensive purification, methods of concentration are receiving considerable technical attention. Specifications, uses and concentration of fluorspar for the chemical, ceramic and metallurgical industries are here discussed from a process engineering viewpoint.—*Editors*

CHEMICAL ENGINEERS are rapidly becoming familiar with fluorspar, a material relatively unimportant in the industry a few years ago. This mineral is of increasing importance to process engineers since: (1) its usage as a raw material for the chemical and process industries is growing; (2) methods of concentration are taking on more of the aspects of process engineering; (3) the operations of milling and concentration are being undertaken by a number of chemical firms.

Fluorspar or fluorite is the most simple fluoride occurring in nature. Theoretically, it contains 51.1 percent calcium and 48.9 percent fluorine but commercial deposits are usually associated with varying amounts of gangue minerals, most of which are harmful in the processing applications for which fluorspar is used. Hence some method of purification must be practiced. Simultaneously with the near-depletion of high-grade domestic deposits, the demand for a high-purity product has increased enormously from inflated chemical and metallurgical uses.

In normal prewar years, fluorspar was imported from France, Germany, Newfoundland, Spain, Tunisia and Mexico. Acid-grade or chemical-grade spar, in particular, was imported in large quantities. During the period 1929-1936 imports averaged close to 50 percent of domestic requirements of this grade of ore. Since a number of hydrofluoric acid plants are located on tidewater, the effect of imports on fluorspar production in the United States will be dependent on relative prices and any possible changes in duty. The price of domestic acid-grade spar will depend to a large extent upon the cost and efficiency of concentration methods.

Recent statistics show that Illinois has supplied about 45 percent and Kentucky about 37 percent of the total fluorspar production in the United States. The remaining 18 percent has been produced largely by Colorado, New Mexico, Arizona, Nevada and Utah. In 1943, Illinois mined $6,300,000 worth of fluorspar out of the country's total production valued at $12,000,000. Some ten mines have supplied approximately 46 percent of the total United States production.

Largest consumer of fluorspar is the steel industry, where it is used as a flux in basic open-hearth furnaces, basic electric steel furnaces and to a small extent in Bessemer furnaces.

Manufacturers of hydrofluoric acid and derivatives are the second largest consumers of fluorspar. The amounts of spar used for such purposes has increased sharply during the past five years. Approximately 128,000 tons of acid-grade spar was consumed during 1944. Some 135,000 tons will probably be used in 1945; capacity of the consuming industry is now being expanded to about 150,000 tons annually.

Fastest growing of the fluorine derivatives, of course, is anhydrous hydrofluoric acid. In the immediate pre-Pearl Harbor years probably not more than 15,000 tons annually of acid-grade spar was used in the manufacture of AHF; the 1944 consumption is estimated at 60,000 tons.

Uses and manufacture of the more important inorganic fluorine derivatives have been discussed by Callaham (*Chem. & Met.*, March, 1945). The field of organic chemistry promises to have a considerable ultimate effect on fluorspar production, ac-

United States fluorspar consumption

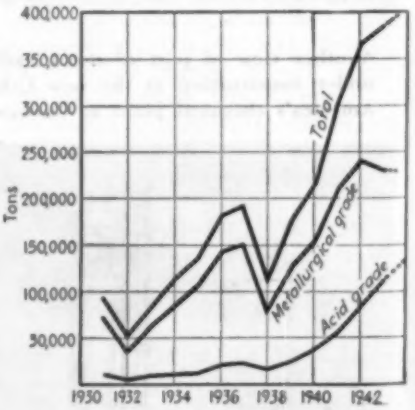


Table I—Fluorspar Consumed in the United States by Industries, Net Tons*

	Industries, Net Tons*				
	1939	1940	1941	1942	1943
Basic open-hearth steel	116,200	143,800	191,300	217,100	232,916
Electric furnace steel	7,600	11,700	18,300	25,300	
Bessemer steel	.....	.....	800	200	
Iron foundry	2,400	2,700	2,600	3,600	12,047
Ferro-alloys	1,100	1,900	2,500	4,200	
Hydrofluoric acid and derivatives	26,300	37,000	56,000	81,600	113,893
Primary aluminum	.....	.....	800	2,000	2,756
Primary magnesium	.....	.....	300	700	2,831
Glass	21,400	18,900	27,600	18,500	20,940
Enamel	.....	.....		3,100	1,717
Cement	.....	.....	900	400	.....
Miscellaneous	1,800	2,500	2,500	4,100	.....
Total	176,800	218,500	303,600	360,800	387,100

* U. S. Bureau of Mines.

cording to Finger (*Chem. & Met.*, June, 1944).

The glass industry, using fluorspar as a flux and opacifier, ranks third in the amounts consumed. When used in the manufacture of opal and colored glasses, some 75 to 500 lb. of ground spar is used for each 1,000 lb. of silica in the glass batch. If a small amount of spar is used it is customary to build up the fluorine content by addition of cryolite. On the other hand, glasses making extremely rich dense opals may use up to 500 lb. Spar used in glass should normally not contain more than 0.12 percent iron oxide, otherwise a green or yellow tint results.

Fluorspar is a flux and auxiliary opacifier in the manufacture of dense, opaque or colored enamels for coating steel and cast iron. Cryolite, however, can be used as a substitute. As much as 12 percent of the enamel batch may be fluorspar or cryolite, but 3 to 5 percent is more normal. Spar used in enamels should be low in iron, lead, zinc and sulphur since these impurities cause stains. The opacity in the enamel appears to be caused by the formation of minute fluoride crystals in the groundmass and not by bubbles of gas.

In the electrolytic reduction of alumina, about 5 percent of the bath is reported to be fluorspar, which acts as a flux. Lime is allowed to build up until the calcium fluoride content of the bath reaches about 12 percent. Overall consumption of spar averages about 0.3 percent of primary aluminum production for the industry, although recently some plants have operated nearer 0.5-0.6 percent. Fluorspar also is the raw material for aluminum fluoride flux and synthetic cryolite electrolyte used in the reduction of alumina. According to the Aluminum Co. of America, some 1,500 lb. of fluorspar goes into the preparation of the aluminum in one flying fortress.

Minor quantities of fluorspar are used, chiefly as a fluxing agent, in the production of finer grades of iron castings, chilled iron, nickel and Monel metal, brass and bronze castings and ingots, magnesium, tin, and in ferro-alloys by the electric furnace process. It is used in the manufacture of carbide, rock wool, cyanamid, compounds for cleaning boilers, as a coating on welding rods, and as a cement for roofing granules. Fluorspar is used in the smelting of some refractory ores of gold, silver and copper, in the extraction of certain rare metals from ores, stripping of anode racks and de-slogging high-pressure steam generators. A small tonnage is still used in cement manufacture, where it lowers the sintering temperature.

Table II—Principal Mills Equipped to Produce Acid or Ceramic Grade Fluorspar

Aluminum Ore Co.	Rosiclare, Ill.
Mahoning Mining Co.	Rosiclare, Ill.
Rosiclare Lead & Fluorspar Mining Co.**	Rosiclare, Ill.
Illinois Fluorspar Mines	Rosiclare, Ill.
Victory Fluorspar Mining Co.	Elizabethtown, Ill.
Cave-in-Rock Spar Co.	Elizabethtown, Ill.
Jas. W. Patton & Sons	Elizabethtown, Ill.
Crystal Fluorspar Co.	Elizabethtown, Ill.
Minerva Oil Co.	Cave-in-Rock, Ill.
Cored Minerals Corp.	Marion, Ky.
Fisher-Pierce Co.	Marion, Ky.
U. S. Coal & Coke Co.	Mexico, Ky.
Harry M. Williamson & Son	Jamestown, Colo.
General Chemical Co.	Valmont, Colo.; Deming, N. M.
American Fluorspar Corp.	Salida, Colo.
Fluorspar Processing Co.	Salida, Colo.
Kramer Mines, Inc.	Colorado Springs; Salida, Colo.
Colorado Fluorspar Corp.	Salida, Colo.
Western Feldspar Milling Co.	Denver, Colo.
Western Fluorspar Corp.*	Northgate, Colo.
Zuni Milling Co.	Los Lunas, N. M.
Indian Metals Co.	Lordsburg, N. M.
International Minerals & Chemical Co.*	Gila, N. M;
Edgar J. Marston	Deming, N. M.
Continental Milling Co.	El Paso, Texas
Tintic Standard Mining Co.	Lund, Utah
Manassa Mining & Milling Co.	Milford, Utah]

* Float-sink plants which have produced metallurgical grade fluorspar.
** The heavy-media separation plant of this concern was described in *Engineering & Mining Journal*, January 1945.

SPECIFICATIONS

As shown by Table III, fluorspar is marketed as metallurgical, ceramic or acid grade. Because of the increased demand, specifications have been changed so that a lower grade product is merchantable to some consumers. At the present time, acid grade containing 97.5 percent calcium fluoride, 1.00 percent silica, and 1.0 percent moisture appears to be the minimum standard. Acid grade is usually sold in a ground form, but consumers do not agree on the most desirable screen analysis. Specifications of ceramic spar vary according to the specific use for which it is intended and the grind required by the purchaser.

Present sales contracts for acid-grade fluorspar are usually based on 97.5 percent CaF_2, 1.5 percent silica and 1.0 percent moisture with a stipulated base price for a ton and provisions for a premium or penalty of 3 percent of this for 1 percent above or below 97.5 percent CaF_2 and a premium or penalty of $0.40 for 0.1 percent above or below 1.5 percent silica.

Crude fluorspar usually contains impurities so that concentration is necessary to raise the calcium fluoride content. The methods used, depending on the nature and character of the crude spar and use for which the concentrate is intended, include selective mining, hand sorting, screening, log washing, gravity concentration by jigs, tabling, or by float-sink in a heavy media, and by flotation.

Very little fluorspar occurs in the United States sufficiently high in calcium fluoride and low in silica to be suitable for manufacture of hydrofluoric acid. Flotation, now the usual method for producing acid-grade spar, was first used commercially in this country in 1928 by the Aluminum Ore Co. at Rosiclare, Ill. Three sink-float plants are now in operation (see Table II).

Crude fluorspar must first be ground to free it from gangue. This is usually done in ball mills in a closed circuit with a classifier. Specifications of consumers on the fineness of the grind vary greatly. A general flotation flowsheet is illustrated, but the nature, characteristics, chemical analyses, and grade of the crude ore may necessitate modification of the circuit.

Composition and characteristics of the crude fluorspar and attendant gangue minerals determine the reagents used in the flotation circuit. Reagents most commonly used are summarized in Table IV. Other reagents less often used include causticized potato and corn starch, sodium sulphite, pine oil, cyanide and various materials containing tannic acid. In addition, soda ash, lime and caustic soda are used to control the pH in the flotation circuit, which is usually maintained between 8.5 and 10.0. As caustic soda possesses dispersing qualities, soda ash is extensively used. This may break down to liberate carbon dioxide, which may act as a beneficial buffer.

Amounts of reagents required depend on the composition of the crude fluorspar and the water in the flotation circuit. In many localities the use of zeolite water softeners may be necessary. If the water in the circuit is kept at about 100 deg. F. a considerable saving may be made in reagent consumption and spar recovery over the use of water at the usual mine or pond temperature.

Final flotation concentrate is usually

(*Continued on page 106*)

Table III — Specifications of Chief Commercial Grades of Fluorspar

	Standard			
	CaF_2	SiO_2	S	Fe_2O_3
Metallurgical	85.5	5.00	0.3	....
Acid	98.0	1.00	0.03	....
Ceramic	95.0	2.5	....	0.12
	Presently Accepted			
	CaF_2	SiO_2	S	Fe_2O_3
Metallurgical	*	....	0.3	....
Acid	97.5	1.0	0.05	....
Ceramic	....	....	....	....

Effective CaF_2 content	Base Price Per Net Ton
70% or more	$33.00
65% but less than 70%	32.00
60% but less than 65%	31.00
Less than 60%	30.00

* Effective CaF_2 content is determined by deducting 2.5 times the silica content from the CaF_2 content.

Table IV—Reagents Most Commonly Used for Fluorspar Flotation

Reagent	Duty	Lb. per Ton Crude Spar[1]
Oleic acid (Red oil)	Collector	1.5
Quebracho[2]	Calcite depressor	0.25
Sodium silicate	Depressant for gangue slimes and siliceous minerals	0.20
B-23[3]	Frother	0.20

[1] In the usual quantities employed under normal operating conditions.
[2] Normally used as a 5-10 percent solution. Recent experimental work has been conducted on the use of chestnut and redwood tannin as a substitute for quebracho.
[3] A higher alcohol with a boiling point above 130 deg. C.

SCIENCE and RESEARCH

Foundations Compete for Official Recognition

Two truly remarkable reports, made in Washington last month, seem to presage governmental recognition and large scale financial support for scientific research. Most interesting is the close similarity in the fundamental viewpoints expressed by both the professional law makers and the professional research scientists. Principal difference, apart from the mechanics of setting up the directing boards of the two foundations, is the greater emphasis placed on a broad program of educational scholarships in the plan proposed by the committees of scientists headed by Dr. Bush.—*Editors.*

"Science—The Endless Frontier"

VANNEVAR BUSH *Director, Office of Scientific Research and Development*

THE pioneer spirit is still vigorous within this nation. Science offers a largely unexplored hinterland for the pioneer who has the tools for his task. The rewards of such exploration both for the nation and the individual are great. Scientific progress is one essential key to our security as a nation, to our better health, to more jobs, to a higher standard of living and to our cultural progress. An adequate program for federal financial support of basic research and scientific education, as proposed in the report, would cost about $33,000,000 at the outset and might rise gradually thereafter.

Early action on these recommendations is imperative if this nation is to meet the challenge of science in the crucial years ahead. On the wisdom with which we bring science to bear in the war against disease, in the creation of new industries and in the strengthening of our armed forces depends, in a large measure, our future as a nation.

Without scientific progress the national health would deteriorate; without scientific progress we could not hope for improvement in our standard of living or for an increased number of jobs for our citizens; and without scientific progress we could not have maintained our liberties against tyranny.

There are areas of science in which the public interest is acute but which are likely to be cultivated inadequately if left without more support than will come from private sources. These areas include agriculture, housing, public health, certain medical research. Research involving expensive capital facilities beyond the capacity of private institutions should also be advanced by active government support.

New impetus must be given to scientific research in this country. Such new impetus can come promptly only from the government. Research cannot be left solely to private industry. Private sources, however, should continue to carry their share of the financial burden.

Since 1900 a large number of scientific agencies have been established within the federal government, until in 1939 they numbered more than 40. While these agencies have showed splendid achievement, they have been limited in function. The government's lack of a national policy for science is regretted. There is no body within the government charged with formulating or executing a national science policy. There are no standing committees of Congress devoted to this important subject. . . . Science has been in the wings. It should be brought to the center of the stage, for in it lies much of our hope for the future.

Scientific research being conducted today in the Departments of Agriculture, Commerce and Interior and the Federal Security Agency should remain where it is and should be continued. Support of agricultural research by grants to the land grant colleges and experiment stations should likewise continue since their contribution lies in applying fundamental knowledge to the departments within which they are established. While recognizing the desirability of keeping the number of independent agencies to the minimum. A new agency is essential to carry out the scientific program as presented.

Expenditures for scientific research by industry and government increased from $140,000,000 in 1930 to $309,000,000 in 1940, and those by colleges and universities grew from $20,000,000 to $31,000,000. Expenditures by research institutes declined, however, from $5,200,000 to $4,500,000 during the same period.

If the colleges, universities and research institutes are to meet the rapidly increasing demands of industry and government for new scientific knowledge, their basic research must be strengthened by the use of public funds.

The deficit of science and technology students, who, but for the war, would have received bachelor's degrees, is about 150,000. It is estimated that the deficit of those holding advanced degrees in chemistry, engineering, geology, mathematics, physics, psychology and the biological sciences will amount in total to about 17,000 by 1955.

The report recommended a program to provide 24,000 undergraduate scholarships and 900 graduate fellowships, which would cost the government about $30,000,000 annually when in full operation. Each year under this program 6,000 undergraduate scholarships would be made available to high school graduates, and 300 fellowships would be extended to college graduates. Those who receive such scholarships and fellowships would constitute a National Science Reserve and would be subject to call into government service in connection with scientific or technical work in time of war or other national emergency.

The government should help industry

Based on "Science—The Endless Frontier," a report submitted July 19 to the President on a program for postwar scientific research.

in its research projects by clarifying present uncertainties in the Internal Revenue Code in regard to the deductability of research and development expenditures as current charges against net income, and by strengthening the patent system so as to prevent abuses which reflect discredit upon a basically sound system. In addition, ways should be found to cause the benefits of basic research to reach industries which do not now utilize new scientific knowledge.

The war against disease in the United States was also discussed in the report. To maintain the progress in medicine that has marked the last 25 years, the government should extend financial support to basic medical research in the medical schools and in universities. We have taken great strides in the war against disease. The death rate for all diseases in the Army, including the overseas forces, has been reduced from 14.1 per thousand in the last war to 0.6 in this war. In the last 40 years life expectancy has increased from 49 to 65 years, largely as a consequence of the reduction in the death rates of infants and children. But we are far from the goal. The annual deaths from one or two diseases far exceed the total number of American lives lost in battle during this war. A large fraction of these deaths in our civilian population cut short the useful lives of our citizens. Approximately 7,000,000 persons in the United States are mentally ill and their care costs the public over $175,000,000 a year. Clearly much illness remains for which adequate means of prevention and cure are not yet known.

There must be more—and more adequate—military research in peacetime. It is essential that the civilian scientists continue in peacetime some portion of those contributions to national security which they made so effectively during the war. This can best be done through a civilian-controlled organization with close liaison with the Army and Navy, but with funds direct from Congress, and the clear power to initiate military research which will supplement and strengthen that carried on directly under the control of the Army and Navy.

One of our hopes is that after the war there will be full employment. To reach that goal the full creative and productive energies of the American people must be released. To create more jobs we must make new and better and cheaper products. We want plenty of new, vigorous enterprises. But new products and processes are not born full-grown. They are founded on new principles and new conceptions, which in turn result from basic scientific research. Basic scientific research is scientific capital. Moreover, we cannot any longer depend upon Europe as a major source of this scientific capital. Clearly, more and better research is one essential to our achievement of our goal of full employment. There must be a stream of new scientific knowledge to turn the wheels of private and public enterprise.

New manufacturing industries can be started and many older industries greatly strengthened and expanded if we continue to study nature's laws and apply new knowledge to practical purposes. Great strides have been made in agriculture, such as control over our insect enemies, better fertilizers, disease-resisting plants, etc.

Advances in science mean more jobs, higher wages, shorter hours, more abundant crops, more leisure for recreation, for study, for learning how to live without the deadening drudgery which has been the burden of the common man for ages past. Advances in science will also bring higher standards of living, will lead to the prevention or cure of diseases, will promote conservation of our limited national resources, and will assure means of defense against aggression. But to achieve these objectives—to secure a high level of employment, to maintain a position of world leadership—the flow of new scientific knowledge must be both continuous and substantial.

The release of war-developed scientific knowledge as soon as it is expediently possible is important so that much of it can be used by industry and by colleges and universities and in training young scientists.

Scientists' Plan

Establishment of a National Research Foundation by Congress for the purpose of promoting a national policy for scientific research and education as proposed in the Bush Committee report is the subject of Senator Magnuson's Senate bill 1285 which provides:

1. That the Foundation be formed to develop scientific research, financially support basic research in non-profit organizations, encourage scientific talent in American youth by offering scholarships and fellowships and promote long-range research on military matters.
2. That the Foundation consist of nine members to be selected by the President and be responsible to him. They shall serve four years and without compensation.
3. That the Foundation have the following five divisions: medical research, natural sciences, national defense, scientific personnel and education, and publications and scientific collaboration.

Lawmakers' Plan

Establishment of a National Science Foundation to be set up as an independent agency of the Federal Government is proposed in Senate bill 1297 introduced jointly by Senators Kilgore, Johnson and Pepper. This bill will:

1. Provide for an increase, above the prewar level, in the government's support of research and development activities.
2. Provide for an efficient formulation and coordination of all such federally supported research and development work, utilizing so far as possible the existing resources of public and private research organizations.
3. Stimulate a general expansion in research and development by private organizations and institutions.
4. Promote a wide flow of scientific and technical information to industry and agriculture and business.
5. Encourage the rapid introduction and full use of scientific discoveries and the most advanced techniques and inventions.

"Role of Research—in War and Peace"

HARLEY M. KILGORE *Chairman,*
U. S. Senate, Subcommittee on War Mobilization

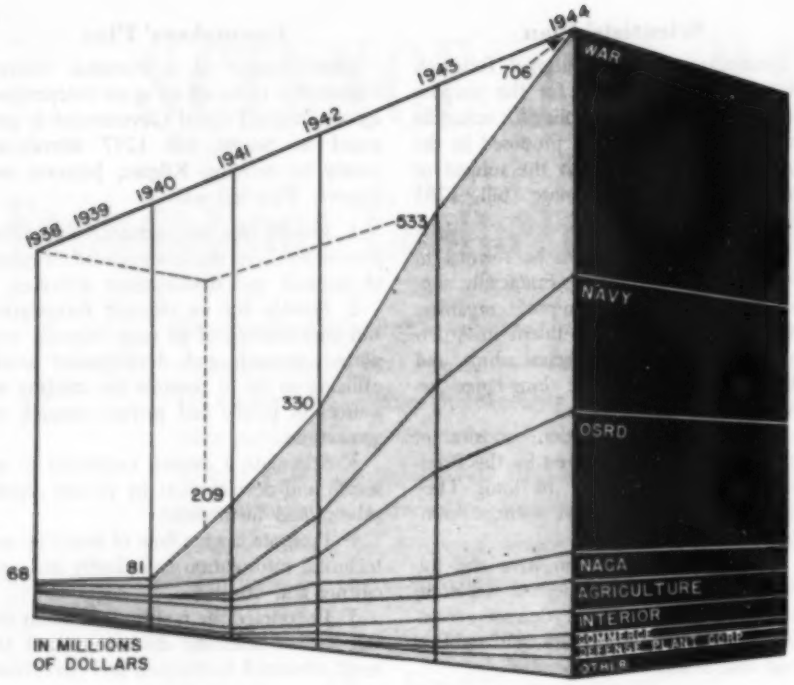
AMERICA'S preeminent contribution to the winning of the war has been the quantity and quality of the materiel furnished our own troops and those of our allies. We and our allies have been able to develop new strategy and tactical operations with these weapons which decisively defeated the advancing Nazi aggressor, and which will as surely defeat through hard and bloody fighting the Japanese aggressor.

In no small measure the initiative of the Germans, which brought them to the edge of victory, must be attributed to the high level of their technological development and the concentration of this advanced technology for aggression.

We, as a peace-loving nation, did not concentrate our resources for military purposes until we were the inevitable object of this aggression. By determined and united effort we converted our rich industrial and technological resources in time to join with our allies in defeating the aggressor.

Research and development gave us substitutes for such strategic materials as rubber and tin; it gave us new metals and synthetics; it gave us new weapons with greater fire power; it gave us detection devices and other counter-weapons; it gave

Based on "The Government's Wartime Research and Development, 1940–44," a report from the Subcommittee on War Mobilization to the U. S. Senate Committee on Military Affairs, Part II, Findings and recommendations.



Wartime growth of federally financed research by sponsoring agencies

This chart shows that federal research expenditures increased more than tenfold from 1938 to 1944, or from $68,000,000 to $706,000,000 a year. The bulk of the increase was in the work of the War and Navy Departments and the Office of Scientific Research and Development, a war-born agency created for the job at hand. In peacetime 1938, War and Navy accounted for only 20 percent of the Federal research budget, but during the war, with OSRD, they increased their expenditures until they were spending 70 percent of a vastly increased budget for research and development. Meantime, all government agencies converted to wartime research, and their peacetime budgets were substantially increased.

us vast improvements in radio communication and electronics; and it gave us these in quantity, through constantly improving mass production techniques. Research and development brought the airplane to new heights and perfection giving us aircraft which embody the most advanced ideas in aerodynamics, electronics, metals, fuels, and instruments.

Government research and government-financed research were primarily responsible for these wartime developments. Government research for the general welfare has also been of great importance throughout our history.

During this war we have striven for full use of our technology, as well as of our manpower and facilities, for the objective of military victory. We cannot afford to slacken our efforts in the fight for peacetime prosperity and permanent security. These two objectives—prosperity and security—are tied closely together. The committee views the problem of national defense research as inseparable from the reconversion of our research activity to high peacetime levels. We cannot afford to return to unemployment of our technical talent, to less than full use of our scientific facilities, to widespread unemployment of manpower and to the economic loss to the Nation which results from the waste of our productive resources.

Because science is decisive, both in war and peace, we must provide for it systematically within the regular framework of the government. Only in this way can we become independent of German science upon which we have leaned so heavily in the past. Our people must support basic research instead of relying on basic research evolving from the government-supported laboratories abroad.

We stand at a crucial point in the promotion of research in the United States. The wartime growth of scientific activity, largely through government financing, raises a variety of questions which demand early answers if we are to bridge adequately the period of readjustment from war to peace.

The subcommittee is not attempting to answer any of these questions precisely but rather to present some facts which will enable the Congress to develop a national policy in the field of scientific research and development.

SIX PRESSING QUESTIONS

The principal questions relating to postwar research are:

1. How high should be the level of the Nation's total scientific activity in the postwar period? How should it compare with the prewar and wartime levels?

2. How much increase may be expected in scientific activity financed by private sources?

3. Should the federal government provide increased support of scientific research above its prewar contributions? If so, how great should be this increase?

4. What particular fields of research should be given support by the federal government? To what extent should such support utilize governmental research facilities; private nonprofit research facilities; private commercial research facilities?

5. Should government organization for scientific work be improved? If so, how should this be effected? Will new research programs require the creation of new agencies or can they be carried out within the framework of existing agencies? Is there a need for a central scientific agency to coordinate existing agencies?

6. What steps should be taken to assure that the results of federally financed research are made fully available to all American industry and business?

Important aspects of these problems are discussed in the report. Although the subcommittee is not prepared at this time to make specific recommendations, it believes that there should be carefully organized support of research activity by the federal government on a larger scale than before the war. The time has arrived for a thorough-going study of specific legislative proposals.

PROPOSED ANSWERS

To this end, several members of the subcommittee have prepared a tentative draft of a bill which provides for increased federal support of science. The proposed bill is summarized in comparison with another on page 101. The version is not a final legislative draft, nor does the subcommittee intend that it should be considered as having the formal approval of the subcommittee. The bill is proposed at this time merely as a working basis for further study. It is hoped that all who are interested in its objectives will feel free to criticize this draft and offer recommendations for improvement.

Any legislation of this sort should be designed to meet the problems of readjustment from war to peace. It should provide for the establishment of a central scientific agency of the government.

This board should consist of the director, acting as chairman, the Secretaries of War, Navy, Interior, Agriculture, Commerce, and Labor, the Attorney General, and the head of the Federal Security Agency, or their representatives, and eight members at large appointed by the President. In exercising his authority and duties, the director would consult with a National Science Board on all matters of major policy.

In general the administrative powers should be vested in the director, but the allocation of funds to specific fields of research and development, the appointment of members to special advisory research committees, and similar duties or authority of primary importance should depend upon the approval of the board.

Thus, by providing guidance and acting as a check, the board would share responsibility with the director for the efficient operation of the foundation.

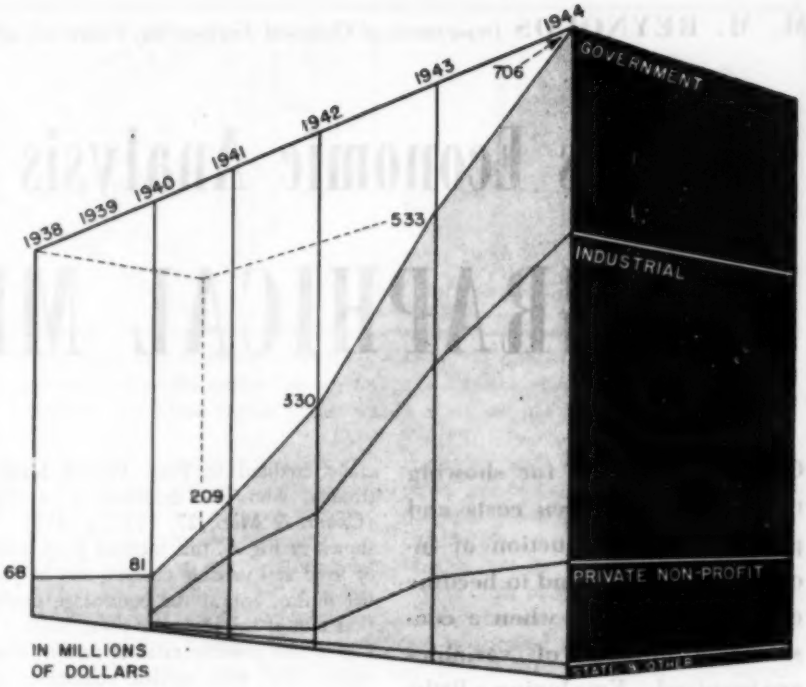
The foundation should not itself, as a general rule, perform any research or development work. Instead, it should make funds for this purpose available to other organizations, public or private, who are already staffed or equipped to do so. Wherever possible, these other organizations, including private individuals, should be encouraged to participate jointly in formulating, promoting, and carrying through the programs and projects which are deemed desirable in the public interest.

The National Science Board should be responsible for determining the allocation of research and development funds within the limits appropriated annually by Congress. As a guide, the proposed bill requires particular attention to be given to these categories of research and development: National defense; health and medical care; basic sciences; natural resources; methods, products, and processes which may be valuable for small business enterprises; and peacetime uses for wartime research and for wartime facilities.

The board should be free to make such allocations of funds to these various categories as it sees fit, except in the case of research and development activities directed specifically toward the advancement of national defense or the advancement of health and medical care or the advancement of the basic sciences. For each of these three categories at least 20 percent of the annual research appropriations should be reserved. As a further guaranty of proper balance in the allocation of funds, at least 50 percent should be earmarked for nonprofit educational institutions and research foundations.

Three special research committees—one for national defense, one for health and medical care, and one for the basic sciences—should be set up within the foundation to advise on the formulation of research programs and to assist in the selection of facilities and the determination of specific projects. Each of these research committees should be made up of representatives of other government agencies, and members at large selected mainly from panels drawn up by the National Academy of Sciences, the American Association for the Advancement of Science, and other scientific groups. Members at large for each committee should be appointed by the director and the National Science Board.

Organizations receiving funds should be free to conduct their research and development work in a manner which they think most productive, subject only to routine supervision and review by the foundation. It is believed fundamental to the foundation's own success in promoting cooperative research and development that individual scientists and technologists should be encouraged to exercise their creative talents and to develop promising new ideas, and, moreover, that they should not be prevented in any way from expressing their personal opinions and beliefs on scientific and technical matters (except when in violation of national security).



Wartime growth of federally financed research by facilities used

The government did not rely on its own facilities for the expanded program of wartime research. Contracts were given to facilities wherever they were available for use. About half of the total federal expenditure for research in fiscal 1944, or approximately $350,000,000 was for work in industrial laboratories. About 30 percent, or $200,000,000, of the expanded wartime program, was in government laboratories, which in peacetime had accounted for 70 percent of the load. Another 20 percent, or $150,000,000, was for work in private nonprofit facilities, such as those of universities and research foundations. The war revealed how extensive our scientific resources are and what they can do.

Besides contracting for research in the national interest, the foundation should be directed to discover and develop scientific talent, particularly in American youth. To this end it should be empowered to grant fellowships and scholarships in various fields of science.

CLEARINGHOUSE FOR DATA

The foundation clearly should make a continuing survey of all research and development activities financed or conducted by the government. Survey data could then be studied to determine what changes in administration or procedure might be desirable. Recommendations would be submitted to the agencies concerned for such action as they might wish to take.

The foundation should also undertake to compile and maintain a comprehensive inventory of the findings and other pertinent data resulting from publicly financed research and development activities. It should be charged with making such information available in the form of reports or publications which could be distributed widely to persons and groups engaged in scientific or technical work. Information concerning inventions and discoveries which have resulted from wartime research and development would be included.

In every way feasible the foundation should be expected to promote a wide distribution of scientific and technical information. Specifically suggested in the bill are abstracts and microfilm reproductions of materials assembled in the foundation's library, and periodic reports reviewing scientific and technical advances and calling the attention of scientists and technologists to new problems that should be solved in the national interest.

To protect the taxpayer's interest, all research and development projects financed in whole or in part by the federal government should be undertaken only upon the condition that any invention or discovery resulting therefrom would become the property of the United States.

The foundation should also be empowered to grant non-exclusive licenses to persons or organizations wishing to use any such invention, discovery, patent, or patent right. No charge should be made for such licenses.

The proposed bill does not specify any fixed amount as the sum which Congress should appropriate annually to the foundation. It merely authorizes such sums as may be needed to carry out the provisions of the bill.

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Process Economic Analysis Aided by New GRAPHICAL METHOD

Graphical methods for showing the relations between costs and profits in the production of industrial products tend to become extremely complex when a considerable number of variables are involved. Employing a little-known geometric device whereby addition and subtraction can be accomplished graphically with triangular charts, the author has introduced a novel graphical method enabling several variables to be handled readily; one of the problems, for example, has five variables including raw material, byproducts and finished product.—*Editors*

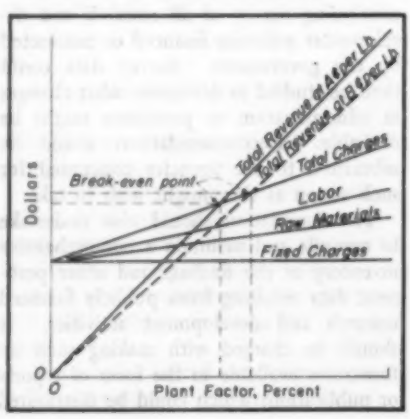
A CONCISE MEANS for demonstrating the economic analysis of a new process is extremely important to chemical engineers since it can make or break a technically promising project. Especially is this true at the present since many economically borderline processes have been necessitated by wartime conditions. Particularly with such borderline processes is it essential to be able to observe readily what effect slight changes in one or more of the variables of the process will have on the over-all economics. On this account executives are placing more reliance upon graphical analysis for distinguishing between marginal and sub-marginal cases. Graphical analysis expedites attainment of a clear picture of the entire question, an important characteristic in these days of increased tempo in industry.

The present accepted method of graphical economic analysis is the one generally credited to Prof. Walter Rautenstrauch, who first described it in 1922 (*Chem. & Met.*, 27, 1922, p. 415). As shown in Fig. 1, this method plots dollars of fixed and variable charges, and of product return, against the percentage production rate of the plant, or plant factor. In Fig. 1 two possible rates of return, which might vary with market conditions, are shown on the same graph. The total cost line crosses the two total revenue lines, giving the break-even points at the two rates of return.

This is a good method for the analysis of an established process, or for a new process which has only a single variable. An example of such a single variable is that indicated in Fig. 1, where at any single plant production rate all of the items of production cost are considered to be constant, while only the revenue shows possibilities for variation. However, even with only one variable the analysis begins to look somewhat complicated when lines are added to represent several values of the variable, as, for example, when several more lines for rate of revenue are added. When the process contains a number of variables, for instance, selling price of the main product and several byproducts, use of the Rautenstrauch method requires several graphs since a single graph tends to become hopelessly complex. To avoid such a multiplicity of graphs and to present a single, clear picture, the writer has developed a new method for handling situations involving multiple variables.

In this method the main feature consists in plotting two variables against each other on an equilateral triangle to give a third or adjusted variable. Several such variables can be paired and combined and the resulting adjusted variables also combined to produce eventually a single variable. This last resultant variable is then plotted against plant factor, using for the latter a series of special scales which take into consideration the non-variables of the process.

Fig. 1—Chart based on Rautenstrauch method, showing plant factors required to break even at two rates of return from sale of product



BASIC THEOREM

This method of employing equilateral triangles for the addition and subtraction of variable quantities is based on the following theorem: In an equilateral triangle three lines are drawn from any point P to the three sides of the triangle, with the lines 120 deg. apart and each line parallel to one of the sides. Each line thus cuts its corresponding side into two segments. The sum of the segments on two sides, which are inclosed by a 60-deg. angle and a 120-deg. angle, equals the segment on the third side, which is inclosed by two 60-deg. angles.

The proof of this theorem is found in Figs. 2 and 3. For example, in Fig. 2 to prove that $a + b = c$, note that $a = a'$ (since they are opposite sides of an equilateral trapezoid); that $a' = a''$ (since they are opposite sides of a parallelogram); that $b = b'$ (since they are opposite sides of a parallelogram); and that $b' = b''$ (since they are sides of an equilateral triangle). Hence, $a'' + b'' = c$. But $a = a''$ and $b = b''$, therefore $a + b = c$.

In Fig. 3 is shown another variation in arrangement of the same theorem. Fig. 4 employs the theorem in reverse direction for subtraction. Note that the segment c (inclosed in 60-deg. angles) has subtracted from it the segment b (inclosed in 120- and 60-deg. angles) to yield segment a (inclosed in 120- and 60-deg. angles). The method has possibilities for confusion if the clue of the inclosing angles is not carefully followed. Once this is done, it can be employed with surprising facility.

This method, worked out while the author was connected with a large chemical concern, was described initially in a talk before the Detroit Junior Group of the American Institute of Chemical Engineers, on which this article is based.

Thus, by placing units on the sides of an equilateral triangle, as in Fig. 5, one can carry out addition or subtraction by following in the direction of the arrows the lines that are drawn parallel to the sides. Fig. 6 shows that the units need not start with zero. Any units may be employed. However, once the units for two sides are chosen, those for the third side are fixed. Nor is it necessary for the units to advance in steps of unity as is shown in Fig. 7 (which gives an example in subtraction). However, obviously, the same steps must be used on all sides of the triangle.

APPLICATION

In breaking down the various cost factors entering into the total cost of a plant product we find that there are various classes of charges, some of which are fixed, regardless of the plant operating rate, while others are fixed per unit of output, but vary in toto as the output varies. Still other charges, however, not only vary in proportion to output, but may also vary per unit of output. For example, at one plant output rate, i.e., at one plant factor on the Rautenstrauch chart of Fig. 1, the total charges break down into fixed charges, including such items as amortization, taxes and insurance, general plant overhead, supervision, supplies, utilities and maintenance. In addition, charges which on the chart are assumed to be fixed per unit of output, but are proportional in toto to the rate of output, are such costs as labor for operation; compensation insurance; payroll taxes; vacation reserve; and charges for raw materials. Thus the total revenue of the plant is equal to the product return, plus the return for any byproducts, less selling cost; while the total revenue, less the total cost of production, equals the net revenue or profit.

Using the method of Fig. 1, if a single one of these classes of charges is variable per unit of output, then a different line must be incorporated in the chart for each value which is to be considered. If there are two or more variables, separate charts, as noted above, will almost certainly be required. In the new method a single chart suffices, and it is only necessary to segregate the variables from the preceding list, grouping the remaining items as non-variables. This does not mean that the non-variables remain constant at various rates of plant output, however, since while some are in fact constant, others are proportional to output. They are thus non-variable only at a given plant factor.

Assume, for example, that both the product selling price and the raw material cost may vary from time to time. Using the equilateral triangle method, the raw material cost can be subtracted from the product selling price, giving an adjusted variable which might be called "gross profit" per pound of product. This "gross profit" is then plotted against a series of special plant factor scales which follow straight line equations, each scale being proportional to a given plant factor or percentage output rate. These scales can be developed and calibrated to show net annual profit which is equal to ("gross profit" per pound of product) × (production) — (the non-variable cost at the particular plant factor). On such a series of scales the break-even point on each scale becomes the zero profit point when the "gross profit" per pound of product, multiplied by the total production for the period under consideration, exactly equals the total non-variable cost for this period.

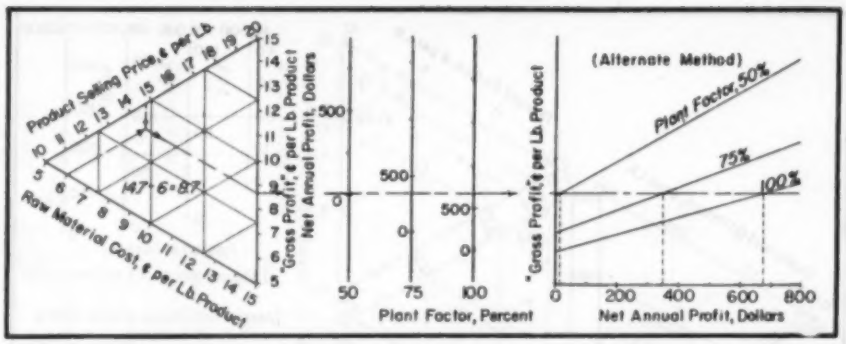


Fig. 8—Here one variable is subtracted from the other and the result applied to net annual profit scales for various plant factors (at right is an alternate method for plant factor scales which is sometimes more convenient)

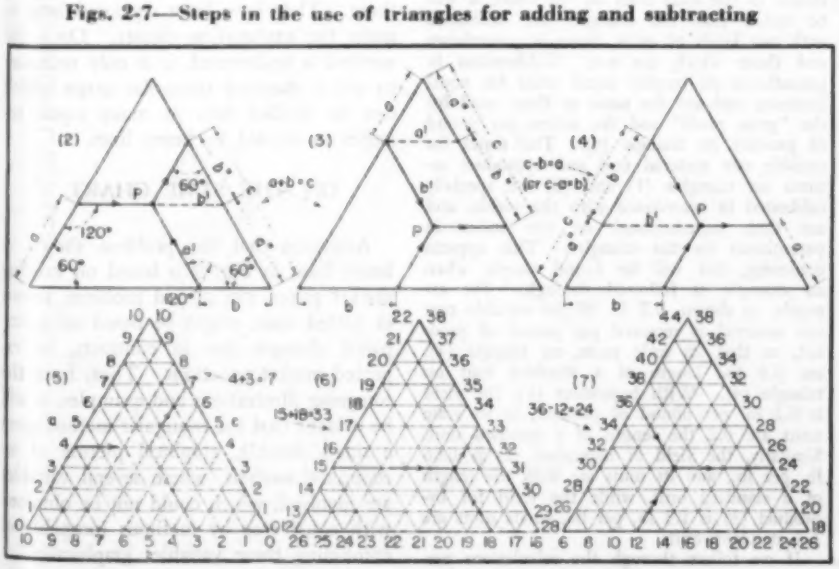
The chart of Fig. 8 was constructed according to the procedure just discussed. It was assumed that 1 lb. of product required 1 lb. of raw material; that the selling price of the product varied from 10 to 20c. per lb.; that the raw material cost varied from 5 to 7c. per pound; that the total plant output was 100 lb. per day for a 300-day year; and that the non-variable cost totaled $1,900 at a plant factor of 100; $1,600 at a plant factor of 75; and $1,300 at a plant factor of 50.

CALIBRATING SCALES

Thus, the triangle was calibrated to give "gross profit" per pound of product by subtracting the cost of 1 lb. of raw material from the selling price of 1 lb. of product. The "gross profit" was then applied to three plant factor scales constructed as follows: For all scales the break-even points, when the net profit is zero, were located. For a plant factor of 100 this point equals the non-variable charges, divided by the total output in one year, or $1,900 ÷ 30,000 = 6.3c. per lb. "gross profit." For a plant factor of 75, the break-even "gross profit" is $1,600 ÷ (30,000 × 0.75) = 7.1c. per lb. For a plant factor of 50 the desired value is $1,300 ÷ (30,000 × 0.50) = 8.6c. per lb.

Since these scales are linear, it is only necessary to locate one additional point on each scale to permit their calibration. One "gross profit" point can be found for each scale where the net annual profit equals some conveniently chosen value, such as $500. For a plant factor of 100, this value equals (1,900 + 500) ÷ 30,000 = 8.0c. per lb.; for a plant factor of 75, it equals (1,600 + 500) ÷ (30,000 × 0.75) = 9.3c. per lb.; and for a plant factor of 50, it equals (1,300 + 500) ÷ 30,000 × 0.50) = 12.0c. per lb. Knowing the three "gross profit" points for $500 net annual profit, then the three linear scales can be calibrated.

Figs. 2-7—Steps in the use of triangles for adding and subtracting



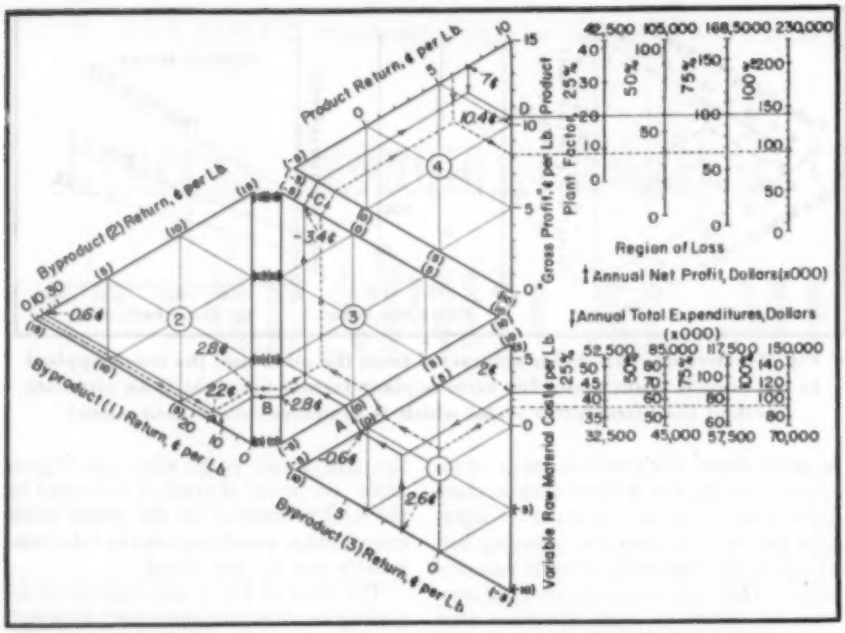


Fig. 9—This chart shows how five variables may be handled graphically; triangle (1) subtracts the selling price of byproduct (3) from the cost of the variable cost raw material; triangle (2) adds the selling prices of byproducts (1) and (2); triangle (3) subtracts the result of triangle (2) from that of triangle (1); and triangle (4) subtracts the result of triangle (3) from the selling price of the product, to give a "gross profit" per pound of product which represents actually the profit on the variable cost factors; the vertical scales in the upper right give net profit per year by bringing in the non-variable factors, while the lower right scales make total annual expenditures quickly evident

At the extreme right of Fig. 8 is shown an alternate method which is sometimes useful for plotting gross profits, plant factors and net annual profits. This method is the equivalent of the one employing vertical, linearly calibrated lines and may sometimes be found easier to use since it is not necessary to calibrate several different lines individually.

FIVE VARIABLES

The case just considered is an extremely simple one which could have been handled adequately by the method of Fig. 1. To jump directly to a complex case involving five variables, consider Fig. 9.

When several variables are encountered, a certain amount of ingenuity may be required in arranging the triangles to combine all variables into a single "gross profit" per pound of product, but the effort expended in this direction should be well worth the time it takes. For example, with reference to Fig. 9, all of the factors included in the total net annual return on the manufacture and sale of one product and three byproducts are examined, and it is found that all charges except the cost of one raw material and the selling price of the product and the three byproducts are non-variable at any given plant production rate. The triangles, of which four are required, are calibrated for the following conditions: 1 lb. of final product requires 0.8 lb. of the variable cost raw material, and with each pound of product, 0.2 lb. of byproduct (1), 0.06 lb. of byproduct (2) and 1.3 lb of byproduct (3) are produced. The triangles are set up in such a way as to add and subtract the various quantities. Triangle (1) subtracts the return from the sale of byproduct (3) from the cost of the raw material, giving a corrected value *A*. Triangle (2) adds the returns from the sale of byproducts (1) and (2) to yield value *B*. Triangle (3) subtracts *B* from *A* to yield value *C*, the net cost (or profit) of raw material plus byproducts. Triangle (4) subtracts the value *C* from the return on the main product, yielding *D*, which is considered the "gross profit" on the processing of the raw material, considering only its cost and the returns on the product and byproducts.

Following through the specific example shown in the solid lines on the chart, it will be noted that the triangles are calibrated with two kinds of units, those in parentheses and those which are not. Calibrations in parentheses all employ equal units for equal distances and are the same as those used for the "gross profit" and the return per pound of product on triangle (4). The scales for variable raw material cost and byproduct returns on triangles (1) and (2) are specially calibrated in accordance with the yields, and are then superimposed on the scales in parentheses on the triangles. This appears confusing, but will be found simple when an example is followed through. For example, as shown, 0.8 lb. of the variable cost raw material is required per pound of product, so that its scale units, on triangle (1), are 0.8 the length of a standard unit on triangle (4). With byproduct (1), the yield is 0.2 lb. per pound of product, so its scale units are 0.2 the length of a standard unit. Similarly, the yield of byproduct (2) is 0.06 lb. per lb., and its units are 0.06 the length of a standard unit, while the yield for byproduct (3) is 1.3 lb. per lb., so its units are 1.3 standard units.

If we follow through the calculations performed graphically by the chart, as shown by the heavy line, when the cost of the raw material is 2.5c. per lb., then for each pound of product the cost is $0.8 \times 2.5 = 2.0$c. At 2c. per lb. return for byproduct (3), the return on its sale is $2 \times 1.3 = 2.6$c. per lb. of product. At 11c. per lb. for byproduct (1) the return on its sale is $0.2 \times 11 = 2.2$c. per lb. of product, and at 10c. per lb. for byproduct (2), the return on its sale is $0.06 \times 10 = 0.6$c. per lb. of product. Thus, $A = 2 - 2.6 = -0.6$; $B = 0.6 + 2.2 = 2.8$; and $C = -0.6 - 2.8 = -3.4$. That is, the net raw material cost, allowing for byproduct returns, is −3.4c., or a profit of 3.4c. per lb. of product. And, if the product return is 7c. per lb., then, according to triangle (4) the total "gross profit" is $7 - (-3.4) = 10.4$c. per lb. of product.

The linear scales shown in Fig. 9 have been added at the right of the diagram to give total annual figures, considering also the non-variable costs at various plant factors ranging from 25 to 100 percent. The upper set of linear scales gives net profits, the lower set, total expenditures for non-variable items, plus the variable cost raw material. These scales were drawn for the following conditions: The fixed charges are $20,000 per year, regardless of output. In addition, certain raw materials are required, plus labor and other items, which total annually $50,000 for a plant output of 2,000,000 lb. per year (100 percent plant factor), and proportionately less for lesser plant output. Thus, the non-variable charges are $70,000 at 100 percent plant factor, $57,500 at 75 percent, $45,000 at 50 percent, and $32,500 for 25 percent plant factor.

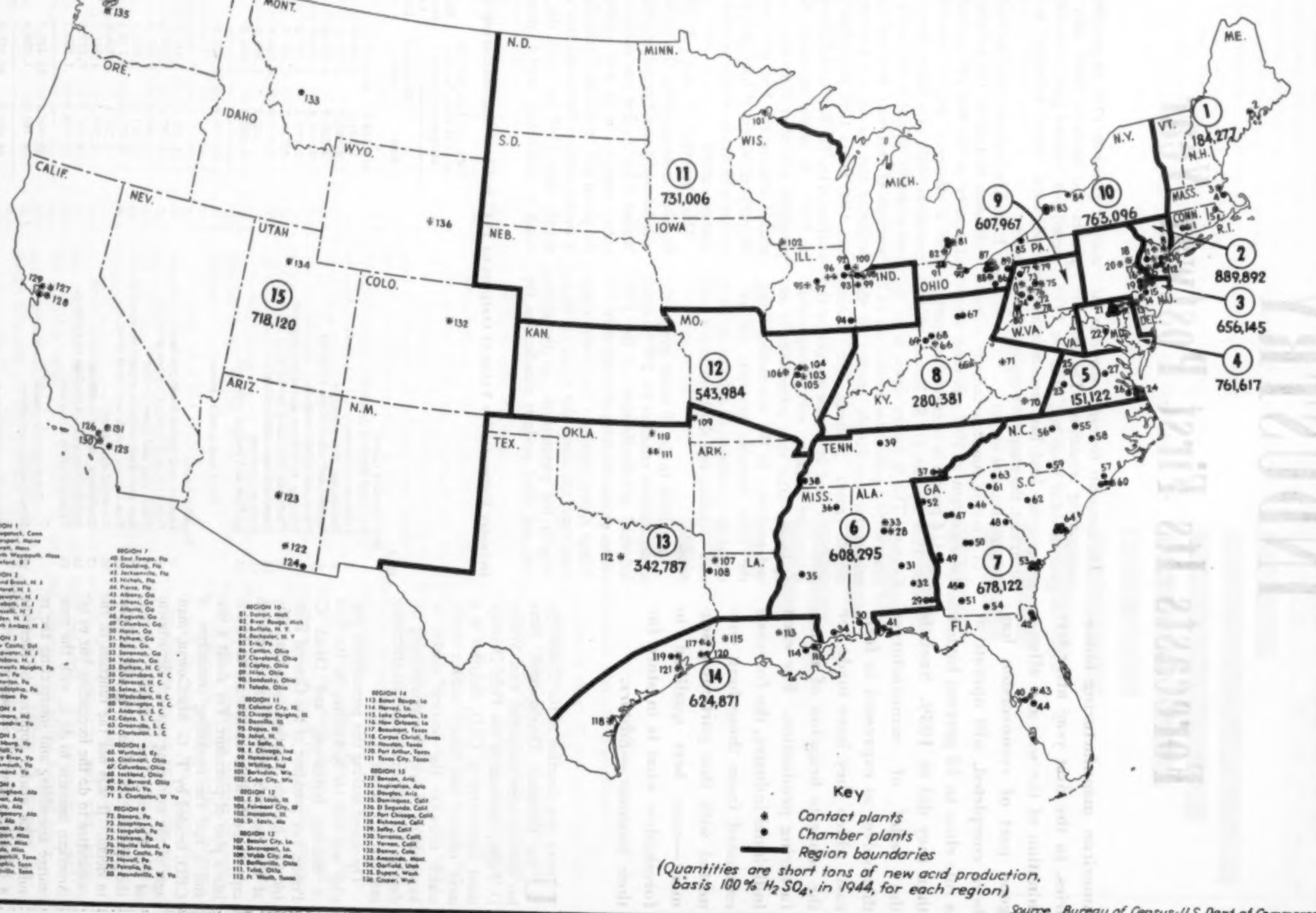
Just as in Fig. 8, the upper scales in Fig. 9 were calibrated by first calculating the non-variable costs for each plant factor percentage, and determining the "gross profit" applied to each annual output which would just equal these values, giving the break-even points on the several scales. These have been labeled zero. Then adding to the non-variable charges some convenient net profit, such as $40,000, the "gross profit" needed to yield this total is calculated for each scale, after which the scales are readily calibrated by proportion. For the lower scales the values at zero variable raw material cost equal the non-variable charges, while the topmost values equal these charges plus the total annual variable raw material cost at 5c. per lb.

Obviously, it is not necessary to separate the four triangles in this diagram in actual use. In fact, use is slightly facilitated, if not clarity, by not separating them. They have been separated here to make the explanation clearer. Once the method is understood, it is only necessary to use a standard triangular graph which can be divided into as many equal triangles as needed by heavy lines.

ON THE SAME CHART

Assuming that the problem shown in heavy lines in Fig. 9 is based on existing market prices, the second problem, shown in dotted lines, might be based on anticipated changes due to contracts, or expected market variations. Thus, from the foregoing illustrations and examples, it will be evident that the triangular method gives a single flexible, graphical picture of an economic analysis, where several variables are involved, which could not be obtained with equal ease by methods incapable of combining these variables graphically.

DISTRIBUTION OF SULPHURIC ACID PLANTS BY TYPES, UNITED STATES, 1944



INDUSTRY

Forecasts Its First Postwar Year

American manufacturing industries, in the first year after termination of the war and after a good part of reconversion has been completed, will operate at a rate close to 42 percent higher than they did in 1939. Such is the belief of manufacturers themselves as expressed in forecasts which they have made for the separate branches of manufacturing production. For each individual industry, the forecasts emanated from those long connected with that particular segment—men best qualified to foreshadow what is in store for their business.—*Editors.*

UNDER THE direction of the Committee for Economic Development, there has recently been completed what Walter D. Fuller, chairman of the Field Development Committee of CED, describes as a most unusual and timely market study, which estimates the postwar market of hundreds of individual manufacturing industries and of American manufacturing industry as a whole.

The job of making this presentation possible was one for technicians in the field of business forecasting, and David C. Prince, vice president of the General Electric Co., brought together more than fifty of the country's leading market research experts and business economists to formulate a plan of procedure. For about a year and a half the marketing committee of CED, headed by T. G. MacGowan, manager of the marketing research department of the Firestone Tire & Rubber Co., had the difficult task of carrying out the plan in detail. It was not the function of the committee to do the forecasting but to get American business to do it, with the committee assembling and interpreting the results. The market appraisal is, therefore, a composite view of postwar markets for manufactured goods as foreshadowed by American manufacturers themselves.

The composite forecast is shown in the accompanying tabulation. The totals are given in dollar value but, since the 1939 average price level has been maintained throughout, the comparison applies only to physical volume of output.

In summary, American industry believes that its output in 1947 will reach a tonnage 41.6 percent in excess of that reported for 1939 by the U. S. Bureau of the Census. This is broken down as an increase of 50.3 percent for durable and 35.7 percent for non-durable goods. In the durable goods grouping, the ranking position is held by a wide margin by the automotive industry with transportation equipment other than automobiles in second position. In the non-durable listing the most favorable prospects are predicted for producers of tobacco products with chemicals and allied products a good second.

In addition to the 20 major groups, the report contains estimates for 290 principal industrial sub-classifications of the 1939 census of manufactures although only 271 listings appear because a few classifications were combined where this would clarify or simplify the presentation. In the chemicals and allied products classification the sharpest gains over 1939 are predicted for plastics and synthetic fibers with compressed and liquefied gases, chemicals and wood naval stores following in that order.

It must be explained that this study was undertaken to establish the probable level of activity in the first full postwar year after a substantial part of industrial reconversion shall have taken place. The year arbitrarily defined in that way is 1947. Selection of that year does not imply a prediction that the war will have ended in such time that a large proportion of the conversion job can have been accomplished by 1947. It merely represents the first peacetime year after conversion and was selected because the first year represents the problem nearest at hand and hence is the one with which industry is immediately most concerned.

This hypothetical year of 1947 is described as inaugurating the catching-up-with-deferred-demand-period and while the forecast is for the first year only, the committee expresses as its own opinion that the period will be of several years duration. It further believes that production will rise sharply after 1947 and until the prewar trend is established several years later.

Industry Estimates for Value of Outputs in 1947 in Chief Manufacturing Groups

No.*		Value of Manufactures at 1939 Price Levels, Millions of Dollars		Estimated Percentage Increase 1947 over 1939
		1939	Estimated 1947	
	Non-Durable Goods			
1	Food and kindred products	$10,618.0	$14,185.6	33.6
2	Tobacco products	1,322.2	2,240.0	69.4
3	Textile and fiber products	3,930.7	4,997.9	27.2
4	Apparel and other fabric products	3,325.0	4,136.3	24.4
7	Paper and allied products	2,019.6	2,579.3	27.7
8	Printing, publishing and allied products	2,578.5	3,359.8	30.3
9	Chemicals and allied products	3,733.7	5,907.3	58.2
10	Petroleum and coal products	2,954.0	4,023.5	36.2
11	Rubber products	902.3	1,329.2	47.3
12	Leather and leather products	1,389.5	1,699.3	22.3
	Total non-durable goods	32,773.3	44,458.2	35.7
	Durable Goods			
5	Lumber and timber basic products	1,122.1	1,412.8	25.9
6	Furniture and finished lumber products	1,267.7	1,872.5	47.7
13	Stone, clay and glass products	1,440.2	2,062.6	43.2
14	Iron and steel products except machinery	6,591.5	9,052.4	37.3
15	Non-ferrous metals and their products	2,572.9	3,710.1	44.2
16	Electrical machinery	1,727.4	2,698.3	56.2
17	Machinery, except electrical	3,254.2	4,961.1	52.5
18	Automobiles and automobile equipment	4,047.9	7,117.6	75.8
19	Transportation equipment	882.9	1,539.1	74.3
	Total durable goods	22,906.7	34,426.5	50.3
20	Miscellaneous industries	1,163.0	1,630.3	40.2
	Total all manufacturing	56,843.0	80,515.0	41.6

* These are the numbers by which these 20 manufacturing groups were designated in the 1939 U. S. Census of Manufactures.

Various situations which will give 1947 a certain transitional character will tend to be minimized or disappear thereafter. The flow of new and better products stemming —like the increase in production—in part from the experience of war, should rise sharply in the later years. Business then will have made progress in reestablishing normal trade relationships and in understanding and acting upon postwar changes and markets.

In outlining procedure for obtaining the estimates the committee agreed that the people best qualified to do the forecasting were those most familiar with the situation and the problems involved—the manufacturers themselves. It was felt that while a great deal of help could be obtained from trade associations, main reliance should be on the manufacturers. Estimates were sought on as many as possible of the more than 400 main subdivisions into which the 23 classifications

Value of Products of Certain Process Industries

	At 1939 Price Level Millions of Dollars		Percentage Increase
	1939	Estimated 1947	1947 over 1939
Chemicals and Allied Products			
Paint, varnish, lacquer	$435.0	$633.0	45.5
Colors and pigments	83.9	125.6	49.7
Cottonseed oil, cake, meal, linters	171.5	168.6	−1.7
Drugs and medicine	365.0	523.3	43.1
Perfumes, cosmetics, etc.	147.5	218.8	48.3
Insecticides, fungicides	93.4	136.9	46.6
Soap and glycerine	302.6	373.8	23.5
Rayon and allied products	247.1	575.5	132.9
Wood naval stores	14.1	24.8	75.9
Fertilizers	185.7	282.0	51.9
Tanning materials	42.2	65.4	55.0
Plastic materials	77.7	203.3	161.6
Explosives	71.1	106.4	49.6
Compressed and liquefied gases	53.4	116.1	117.4
Bone black, carbon black and lampblack	14.6	24.3	66.4
Printing ink	49.1	62.2	26.7
Glue and gelatin	34.3	40.3	17.5
Mucilage and paste	4.2	5.3	26.2
Chemicals, n.e.c.	839.8	1,481.1	76.4
All other	501.5	741.6	47.9
Group total	3,733.7	5,907.3	58.2
Other Process Industries			
Liquors distilled	56.1	126.3	125.1
Baking powder, yeast, etc.	31.3	36.4	14.5
Corn sirup, sugar, starch	119.4	165.7	63.9
Dyeing and finishing, except wool	271.2	383.2	45.0
Linoleum, floor coverings	69.9	110.6	58.2
Artificial leather and oil-cloth	43.4	78.8	81.6
Wood preserving	106.3	172.8	62.6
Pulp mills	226.9	275.9	21.6
Paper and paperboard	933.0	1,148.7	23.1
Coated and glazed paper	84.4	107.6	27.5
Petroleum refining	2,461.1	3,324.0	35.1
Coke-oven products	342.2	442.2	29.2
Tires and inner tubes	580.9	849.7	46.3
Reclaimed rubber	6.9	9.6	39.1
Other rubber products	314.5	469.9	49.4
Leather, tanned, curried and finished	346.4	391.8	13.1
Flat glass	102.4	147.6	44.1
Glass containers	158.3	214.6	35.6
Tableware and glassware	97.3	131.9	35.6
Cement	192.6	261.8	35.9
Clay refractories	42.2	50.7	20.1
Gypsum products	46.2	71.4	54.5
Lime	37.0	49.7	34.3
Minerals and earths, ground or treated	38.9	50.2	29.0
Nonclay refractories	26.9	39.7	47.6

Industry estimates for increases in chemicals and allied products

in the 1939 census of manufactures was divided. Emphasis was especially centered on some 210 sub-classifications which in 1939 accounted for more than 85 percent of the total value of American manufactures.

Manufacturers were asked not to make estimates for their own companies but for their industries, their findings to represent the amount of business they thought would actually materialize in their respective industries, the only assumption which was necessarily to be common to all estimates was the very arbitrary one that 1947 will be the first full postwar year and that by that year a very substantial part of reconversion will have been completed.

A brief summary of the number and general scope of the estimates received follows:

"A total of 1,564 manufacturers and manufacturers trade associations supplied the figures. There were forecasts from 158 trade associations and from 1,406 manufacturers.

"Some forecasters covered more than one industrial sub-classification. Some of the forecasts were for one reason or another unusable. The total number of industry estimates actually used was 1,674.

"Out of the 411 principal sub-classifications in the 1939 census of manufactures we obtained and used forecasts in 352 representing about 97 percent of the value of manufactures in 1939.

"The average number of estimates used for each of the 352 industrial sub-classifications for which estimates were obtained and used is 4.8.

"There were 119 industries with five estimates or more; 36 with four; 48 with three; 68 with two; and 81 with one.

"Detailed comments, explanations and answers to questions were received from 488 estimates.

"The trade associations which cooperated in the study have a combined membership of more than 20,000 manufacturers."

Giving full consideration to the fact that these are long-range forecasts made for a period when a confusing mixture of favorable, unfavorable, and uncertain factors may well be operative, the committee is of the opinion that in general the forecasts are very good. It points out that these estimates come from business men—men who over the years have successfully solved their problems and who know their industries. The summation regarding the reliability of the forecast reads:

"The over-all picture is probably far better than anything that any one economist or small group of business analysts could hope to achieve.

"Most of the forecasts are probably good.

Many of them are undoubtedly exceptional. Any element of poor estimates is probably exceedingly small."

Commenting further the committee feels that regardless of how good or how bad the estimates may be, either when viewed as a whole or on an industry-by-industry basis, they do constitute industry's own idea as to what will occur after the war. As such they are of tremendous value as a check on the current and recent state of manufacturers' anticipations and plannings. Business men have to act in accordance with what ideas they possess and all over the country business men engaged in manufacturing are making plans and engaging in actions based on their ideas regarding postwar markets. It is important to know what they think because if they are thinking at too high or too low a level, something can then be done to bring their thinking into line with more realistic viewpoints. If, on the other hand, and the committee believes this is the more probable, their judgment is in the aggregate sound, that judgment can be a most valuable tool for those who must plan and act for the economy as a whole.

However, it is stressed that these are forecasts and the individual interested in any one line of manufacture should not blindly accept the view presented for his industry without making his own study to substantiate or disprove it.

INDUSTRY COMMENTS

In conjunction with their estimates, manufacturers were asked to answer questions covering a group of key points which affect the postwar situation of manufacturers. A brief high-spot review of their comments follows:

Reconversion—In 1943 when the difficulties of reconversion were first being widely discussed they appeared to be very large. At that time it appeared that in many industries this would require nearly a full year or more and entail the laying off of many workers. It may be that when business realized the danger of this unemployment it began to study methods of speeding up the reconversion process. At any rate it now seems that reconversion is not the problem which it appeared to be some time ago.

It should be obvious that many industries have been making exactly the same products during the war that they made in peacetime. It also appears that layoffs of workers may not be nearly as large as was earlier expected; while in some cases the layoffs will be permanent, in most companies having a reconversion problem they will apparently be of short duration.

New Products—Some industries have in mind many new products while others have not. Most of these new products seem to be in the same line as the industry had previously been engaged in, but there are some in other and competing industries. In addition there is considerable mention of improvements which will be made as a result of the acceleration and development brought about by the war. Generally, these new products are not expected to add more than 10 or 15 percent to the industry's volume but there are a few reports which indicate adding as much as 40 to 50 percent.

Adequacy of Supplies—In some industries supplies are now adequate while shortages still exist in many others. Where raw materials are imported there is of course considerable uncertainty. Since new machinery for production has been made during the war only under very strict priority, there exists great shortages in many industries in the machinery needed for postwar expansion.

Government Owned Goods—Since the War Department has not released data on the size of its stockpiles for military reasons, industry has a difficult time in appraising the effect upon it of the release of these government-owned goods. In many industries these stockpiles are not thought to be very large but are believed to be located in foreign countries and so are not expected to disturb the domestic market when released. It is the opinion of most industries that these government-owned goods can be absorbed in a few months or within a year or so. Almost without exception, however, industry hopes that these goods will be disposed of in an orderly manner and it is the concensus that if they should be dumped upon the domestic market, the effect will be disastrous.

Government Plants—In many industries it is stated that the government owns no plants or machinery and so the industry faces no problem on this score. In other industries many plants and considerable production machinery are owned by the government and considerable concern is expressed over their disposal. Many suggestions are made but the most common opinion expressed is that these plants should be disposed of by selling or leasing them to their present operators or other concerns. Frequently it is stated that unusable or unsalable plants should be held as standby plants for future needs and several reports frankly say that this kind of plant should be scrapped. It is the general opinion that each industry should be consulted as to the needs of disposing of excess plants and machinery.

Cancellation of Contracts—Evidently enough contracts for war production have already been cancelled and handled with such satisfaction that industry no longer has very great fears as to the effect of such cancellation. Many industries say that cancellation of their contracts will have no adverse effect while others expect some temporary shutdowns and unemployment. Estimates of the time which will be required to return to normal of course vary widely within any one industry and between industries. Most of them run for a few months to a year depending upon the industry concerned.

Continuance of War Controls—There has been so much discussion of the hampering influence of war controls that one might expect nearly all the industrialists reporting to want all these ended at once. However, the majority say frankly that these should be discontinued gradually and many state that their continuance will have no ill effect upon their industries. Many companies say rather definitely that the result of cancellation of war controls depends almost entirely upon how such cancellations are handled rather than the mere fact that they are being cancelled. On the other hand, a sizable majority of companies feel that wartime controls are restrictive of volume and should all be discontinued without delay.

Foreign Trade—For some industries raw materials have to be imported and until normal imports can once more be had, such industries face many problems. However, there does not appear to be much concern about imports but the general feeling is that most foreign countries which have been the source of these imports have been ruined industrially and that it will be many years before they once more become a serious threat. On the whole, most industries appear not to be counting on too much of their volume coming from the export market. A few, however, appear very enthusiastic regarding the possibility for a substantial volume to be enjoyed from exports.

Accumulated Demands—Once more replies are dependent upon the nature of the industry reporting. Many articles have not been manufactured at all during the war and of course for these there is a large accumulated demand which will require from one to several years to wear down to normal. Many other industries which have been restricted in their volume during the war are not affected by this accumulated demand. On the other hand, the accumulated demand for some industries reaches proportions which are frankly staggering. Estimates as to how long it will take to supply these accumulated demands vary greatly from industry to industry but in many instances this will require a year or two and in some cases even longer.

Accumulated Savings—The majority of industries feel that accumulated savings will have no direct influence upon their market or production but nearly all agree that these will indirectly be very beneficial. It is pointed out that accumulated savings will tend to influence the spending of current income and therefore will have a great effect upon most current production. Many mentioned the stabilizing character of such savings and all look upon our accumulated savings as a bulwark for future prosperity.

Gas Turbine Uses Rotary Compressors

For the first time, it is claimed, successful use of positive rotary compressors has been made in a power production unit of the gas turbine type. At a press conference on July 25 the U. S. Navy, jointly with the manufacturer, The Elliott Co. of Jeannette, Pa., unveiled the 2,500-hp. prototype of two gas turbine power plants which are shortly to be constructed for marine use. In the opinion of the maker, the same principles have important postwar possibilities for industrial and oil refinery use, as well as for locomotive propulsion.

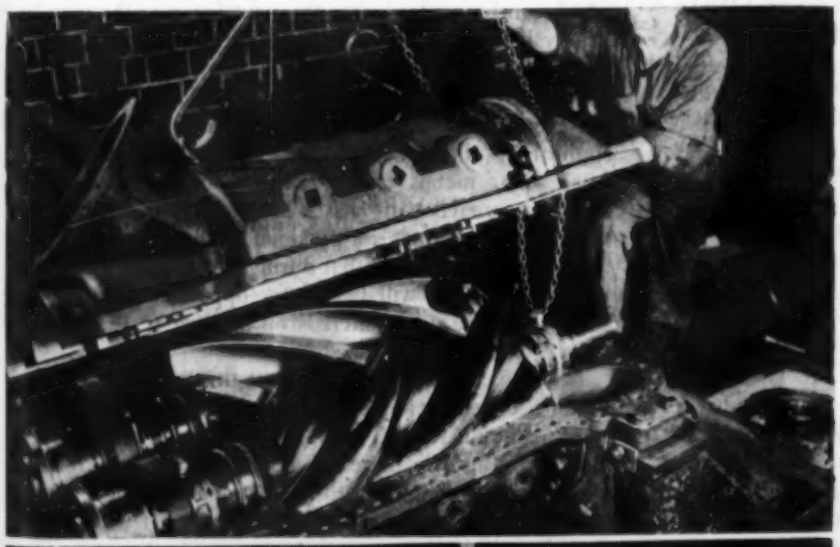
Although the principles of gas turbines have been well publicized in the last few years, there are many new features in the particular arrangement designed by Elliott. Perhaps the most important is the use of positive rotary compressors. Axial flow and centrifugal compressors have characteristics which limit their efficiency, particularly at starting and under partial load conditions. The Elliott-Lysholm compressor used in the new arrangement is a true positive compressor, using two screw-shaped rotating elements of odd design, meshing in a figure-of-eight casing. The meshing elements engage in such a way as to compress the successive "bites" of air as they are conveyed from the intake to the discharge. These "bites" then overlap so as to produce continuous flow.

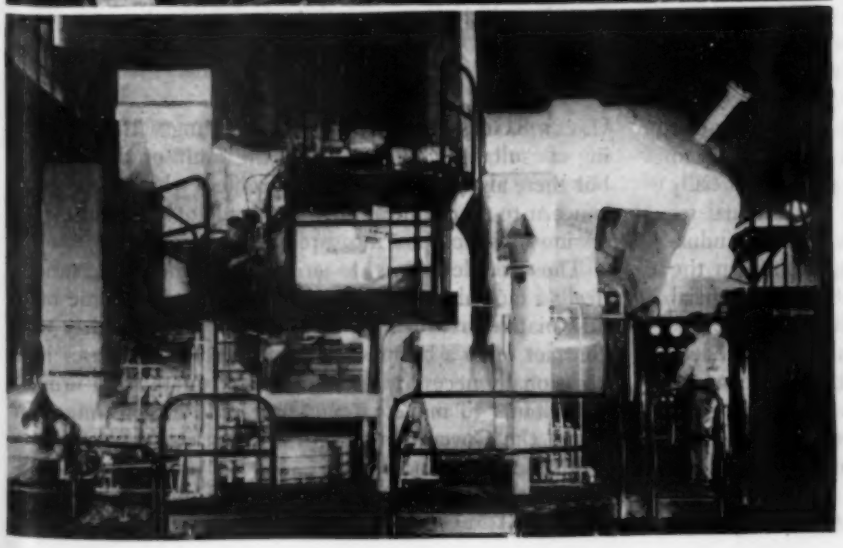
This compressor, originally developed as a supercharger by Alf Lysholm, chief engineer of Aktiebolaget Ljungstroms, Angturbin, Sweden, and improved to its present state by the Elliott organization, appears to have striking possibilities in fields other than those now exploited.

Although various gas turbine cycles can be employed, the one demonstrated by Elliott uses eight principal parts including two compressors, two combustion chambers, two turbines and two heat exchangers. Air is taken in by the low pressure compressor and compressed to 43 lb. per sq. in. abs., then cooled in an intercooler and compressed to 96 lb. in the second compressor. After passage through the regenerator it is used to burn high grade fuel oil in the first stage combustion chamber, producing hot gases at 1,230 deg. F. Expansion through the first turbine to 53 lb. produces enough power to drive the low pressure compressor. The gases then pass through the second combustion chamber, being re-heated to 1,207 deg. F., and flow through the second turbine, producing 5,000 hp., of which 2,500 hp. is needed for the high pressure compressor, leaving 2,500 hp. net power output. One man controls the entire system which is much easier to start up and shut down than a comparable steam plant. The thermal efficiency is better than the best steam plant, but slightly poorer than the best diesels.

From the second turbine the gases pass through the regenerator, which contains 8½ miles of nickel tubing, where they are cooled to the 400 deg. F. stack temperature in heat exchange with the 96-lb. air from the high pressure compressor.

Above is the Elliott-Lysholm compressor, opened to show the peculiarly shaped rotors; below, the entire 2,500-hp. gas turbine unit with its controls





FLUORSPAR

(*Continued from page 99*)

pumped to a thickener, and the thickened pulp pumped to a filter. As most acid-grade fluorspar consumers insist on a moisture content of 1 percent or less, the filter cake is usually passed through a rotary dryer before shipment. The organic content of the concentrate must be eliminated to avoid difficulties in the hydrofluoric acid still caused by the tendency of the spar particles to float on top of the acid charge. This organic matter is largely due to the adherence of oleic acid to the fluorspar particles. It can be removed by chemical means before the pulp is pumped into the thickener so that the impurities will be discharged in the overflow or by sufficient heat in the dryer to burn the organic material. If the former method is used, the recirculation of mill water is usually precluded.

Standard flotation cells are generally used but some of the smaller operations have failed because of insufficient cell area. The use of deep type cells has been satisfactory for some ores. Under usual conditions it is not economical to mill crude ore containing less than 50 percent CaF_2. The recovery of fluorspar in the concentrates normally increases as the grade of the feed increases. In good operations, a recovery of 80 percent in the concentrate may reasonably be expected from average crude crystalline ore containing 51 percent CaF_2, whereas a recovery of 95 percent has been attained from mill heads assaying 90 percent.

FROM THE VIEWPOINT OF THE EDITORS—

RESEARCH OFFICIALLY RECOGNIZED

THE PUBLIC'S need for scientific research was never better recognized than in the two reports and recommendations which are reviewed in this issue of *Chem. & Met.* Fortunately this recognition comes both from Congress and from the professional scientists of the executive departments. These reports should initiate a plan of great public importance for the permanent federal support of science and education in America.

A few years ago when Senator Kilgore was leading a campaign for the "mobilization" of research and technology, no one could have anticipated that by this date he would have so far changed his position as to make the report of his subcommittee almost a replica of the recommendations by the eminent scientists of the committees headed by Director Vannevar Bush of OSRD. Mr. Kilgore's report urges the establishment of a National Science Foundation with recommended functions that largely duplicate the proposed duties for the National Research Foundation proposed by the Bush Committee.

There are, of course, numerous differences in detail; but the two proposals so strikingly resemble each other that from this point on there will be principally two questions. . . . How much will the Government spend? And how promptly will the Government act to start this spending?

SWIM FOR YOURSELF

AUTHORIZATIONS for new construction of process-industry plants, including pilot units and remodeling programs, are now being granted by WPB with unrated approvals. The great advantage of this plan is often obscured by the consequent incidental difficulty in getting certain few essential materials or equipment items. As a consequence, both management officials and engineering spokesmen have at times been mislead into demanding rated instead of unrated approvals.

An unrated order does not insure that a company can get everything it needs, but it does permit the company to go ahead largely on its own plans and at least partially execute its new construction programs. This gradual release from the dictation of Washington permits the industry to swim for itself, instead of paddling around in the shallow end of the pool under the dictates of an official swimming instructor. That is a good thing.

Frequently some specific governmental aid is needed. For example, a certain bit of equipment or some scarce material of construction may hold up a whole program because all of that sort of goods may be going on high priority ratings. If such is the case, then there is justification for asking for a rating at WPB; and such rating will usually be given promptly. But the rating need apply only to the scarce equipment or material. It need not apply to the entire job.

Those who have tried this scheme of limiting their requests for ratings to those things really scarce are finding it a great advantage. It will be well if many others follow this method too. We must somehow escape from detailed governmental control of every phase of industry. We can begin our own release by this method. And we should.

TIN, THE BOTTLENECK

NO OTHER single commodity is causing so much difficulty in general industrial reconversion as the shortage of tin. The number of automobiles, the number of household devices, and the number of industrial containers which can be made during the next few months may be strictly limited because of this scarcity.

Chemical engineers must take account of this fact and learn to do without tin wherever possible. But chemical engineers can also use this situation for the accelerated application of tin substitutes. There are many places where light metals can take the place of tinned iron. Metals lacquered with plastic instead of tin are already serving as containers for food and industrial commodities. It is quite possible that during this period of extreme tin scarcity there will be greater opportunity for application of these new materials on a larger scale than we have ever before visualized.

Let us see if we may not convert this problem of scarcity into a development opportunity for many products of process industries. There are selfish advantages in such planning. But also there will be great advantages for the general public which can thereby get end products sooner than would otherwise have been possible. It is fortunate that the selfish purpose is thus also a patriotic one.

SINS OF CONSULTANTS

UNCLE SAM is having difficulty in dealing with engineering consultants. This is partly the fault of the system, but there also is a phase of the problem which is of great concern to all chemical engineers and for which the profession must accept a measure of the responsibility.

The trouble seems to arise when the Government needs a factual impartial engineering review of some business matter in which an official agency is one party to a contract or to a business negotiation. In such cases it is occasionally necessary to engage a consultant or a firm of consultants to make a report on some establishment in which the Government is either proprietor or in part responsible for financing.

In such cases the Government does not want partisan findings. It wants facts interpreted by impartial engineer-

ing judgment. Often times the governmental officials feel that they do not get such reports. In one recent instance it is certain that they did not. In that case three or four engineering reports were obtained from different consultants in which the engineering facts were presented so differently that values and costs were as much as three times as great in one report as in another. An important Government engineering executive said of this case, "You could readily see that every part of these reports represented partisan argument and not independent engineering judgment."

Already some important officials, even those of technical background, are forced to be suspicious of the combination businessman-engineer approach in such negotiations. One of the most aggravated cases is the one referred to where consultants have obviously distorted their judgment for what appears to be a partisan cause. It is time that the engineering profession took a hand in these matters. Unless we do, the whole set of dealings will be conducted in an atmosphere of suspicion which may preclude effective business arrangements. It is hard enough any time to arrange a simple business deal with government executives within the restrictive laws fixed by Congress. It will be immeasurably more difficult if the government does not believe in engineering reports.

NEW SALARY FREEDOM

CEILINGS on wages and salaries have not yet been lifted. But the Office of Economic Stabilization under William H. Davis has begun to recognize certain wider fringes of action in making such adjustments for professional people. It is important that these opinions be studied by each management, and that they be utilized where necessary for a sound program of postwar employment of professional workers.

A tremendous number of technical and executive workers in process industries are becoming restless. They hear of marvelous new opportunities for employment. They wonder why they should not share in these. Many companies are going to lose a number of their best men as a result of this unless something constructive is done about it.

Perhaps the most important single reconversion task facing process-industry executives is to formulate a program of procurement and utilization of technical brain power. At no time has there been such scarcity of professional skills compared with the size of the jobs to be done. This means three things: First, it is necessary to appraise the whole postwar program of a company to see where more technical manpower is going to be needed. Second, it is important to appraise the company payroll to determine which part of the postwar job will be assigned to the good technical men still left in the company's service. Third, and only then, should the company go outside to find the new people which it needs, because only then can it do so prepared both to protect its investment in present employees and to select new people of a sort exactly suited to the jobs at hand.

It is now possible to assign present staff personnel to new assignments with appropriate salary adjustments and with appropriate assurances for the future. Unless that is done before new hiring goes too far, a management may find as did one big chemical company lately that they not only must hire some new men to fill vancancies, but they must also hire several men to take jobs from which competent but discouraged employees were lost because of disappointments or misunderstandings.

BLASTING OPEN THE FUTURE

Now that the war's most effective screen of secrecy has been partially lifted and we have been granted a glimpse of the results of five years of intensive research and development in the release of atomic energy, the world is truly amazed by its portents. No one, to our knowledge, is yet competent to predict its possibilities. By now we do know that the best efforts of many thousands of physicists, chemists and engineers have been rewarded with another great tool of science that must ultimately be put to constructive uses for mankind.

In spite of the truly remarkable degree to which the secret was kept, most well-informed engineers knew in a vague sort of way what was going on in the cellars of Columbia, Chicago and Cal. Tech., in the Washington offices of the Manhattan Engineer project, in the proving laboratories in New Mexico, in the fantastically large chemical and metallurgical plants near Knoxville, Tenn., and Pasco, Wash., that we facetiously called "Willkie Button" factories or the "Horsehead" experiments. Hundreds of our friends took part in the work that was headed up by the largest of our chemical companies—DuPont, Eastman, Carbide, Monsanto, to mention but a few. There were scarcely any chemical and process equipment manufacturers who did not supply at least some piece of machinery that went into the complicated flowsheets of the "Super Hush-Hush." Nevertheless, with so many people and companies part way "in the know," only a few knew the answer to the all-important question—would it work? Could it ever be made to work?

Now we know that answer—and so do the Japs. It does work. Whether one of the three best known isotopes of uranium, perhaps U-235, is being used—or whether it is the man-made element No. 93, Pluto—evidently exceedingly complex problems in chemical engineering have been solved in the concentration and purification of the active material, while at the same time means have been perfected to initiate the atom splitting and to cause it to continue with explosive violence throughout the entire mass of the material. In July, 1940, before official censorship banned all mention of atomic fission, and particularly of the uranium isotopes, one of our colleagues, *Power's* editor, P. W. Swain speculated most interestingly on the future of such an energy source. He calculated that if U-235 could be split at a slow controllable rate into two atoms of approximately half the weight of the original atom, 37 billion B.t.u. would be released per pound of product—equivalent to the energy in 1,370 tons of 13,500-B.t.u. coal. Applied to destruction by instantaneous release, this tremendous energy output becomes, as we now see it, a far more devastating explosive than this sadly damaged world has previously known.

Unanimously, the scientific and engineering professions will hope for the day when constructive use can be made of this new force through the slow release of its energy in performing more important parts in the world's work. That day, judging from apparently well-founded predictions, may not be too far in the future.

CHEM. & MET. PLANT NOTEBOOK

THEODORE R. OLIVE, Associate Editor

$50 WAR BOND FOR A GOOD IDEA!

Until further notice the editors of *Chem. & Met.* will award a $50 Series E War Bond each month to the author of the best short article received during the *preceding* month and accepted for publication in the *"Chem. & Met. Plant Notebook."* Articles will be judged during the month following receipt, and the award announced in the issue of that month. The judges will be the editors of *Chem. & Met.* Non-winning articles submitted for this contest may be published if acceptable, and if published will be paid for at space rates applying to this department. (Right is reserved, however, to make no award in months when no article received is of award status.)

Any reader of *Chem. & Met.*, other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 300 words, but illustrated if possible. Neither finished drawings nor polished writing are necessary, since only appropriateness, novelty and usefulness of the ideas presented are criteria of the judging.

Articles may deal with any sort of plant or production "kink" or shortcut that will be of interest to chemical engineers in the process industries. In addition, novel means of presenting useful data, as well as new cost-cutting ideas, are acceptable. Address entries to Plant Notebook Editor, *Chem. & Met.*, 330 West 42nd St., New York 18, N.Y.

JULY WINNER!

A $50 Series E War Bond will be issued in the name of

I. J. Hooks and Frank Kerze, Jr.
Department of Chemical Engineering
New York University
New York, N. Y.

For an article dealing with a new nomograph for estimating conveyor horsepower required, which has been judged the winner of our July contest.

This article will appear in our September issue. Watch for it!

June Contest Prize Winner

SIMPLE SCHEME FACILITATED REPAIR OF COLUMN BASE IN A FIVE STORY MILL TYPE BUILDING

CHESMAN A. LEE
Engineer, Darling & Co.
Chicago, Ill.

IN THE MAINTENANCE of a five story building of "mill-type" construction it was found that one of the main columns was badly rotted at the first floor level. Replacing such a column requires not only re-supporting two girders at the second floor level, but also transferring the load from the entire tier of columns all the way to the roof. However, a relatively simple method was worked out for accomplishing this so that the foot of the column could be cut off and then set on a pier. The same method should be useful for similar repairs.

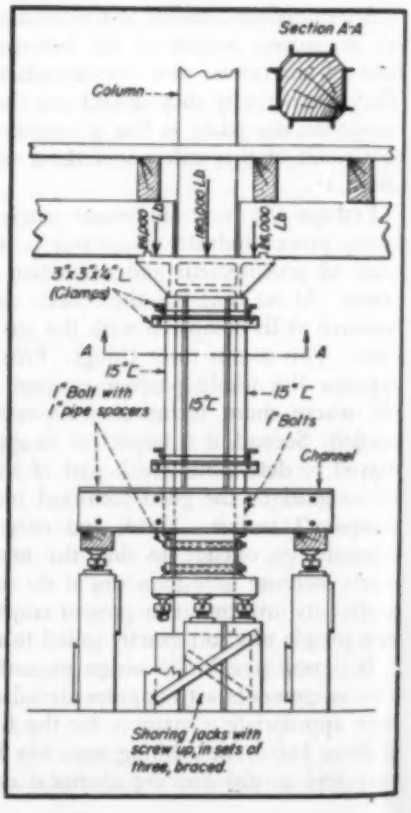
How the problem was solved is shown in the drawing. First, four channels were fastened to the sides of the column so as to bear evenly under the main part of the column cap. Horizontal channels were installed under these at a height convenient to set on 12 shoring jacks of 25 ton capacity. After the jacks had been braced securely they were raised slightly and with them the whole tier of columns, enabling several feet of the rotted portion at the bottom to be sawn off. Then a concrete pier was poured, using a rich, high-early-strength concrete mix (1:2:3).

It should be noted that simply to shore up under the two ends of the cap would not be satisfactory, although they seem made-to-order for that purpose. They were designed to carry one floor load only, and at least one serious collapse was caused by trying to handle a job that way. Therefore, it is necessary to have the bearing under the main part of the cap, and this can be on two or four sides, depending on the floor loads. Of course, it was necessary to figure the entire load on the tier of columns before the job was started.

Two jobs of this character were handled by the writer, and each ran up against an unexpected psychological problem. The millwright in one case, and the contractor in the other, were both familiar with shoring style jacks, which are ordinarily used with the screw end down. Both objected seriously to setting the jacks "upside-down," as shown in the drawing. However, a little analysis will show that the proper bracing of the jacks is simple only if the housings are set solidly on the floor with a timber between. Hence, it is desirable to be very firm on this point.

Incidently, there is only one other way to handle a job of this type, which is much more difficult and complicated. That is to shore up, girder to girder, all the way down from the roof. At the lower floors one must check to avoid crushing joists, when these are set on top of girders. Handled this way, the entire column can be safely replaced. In our case, however, and in most such cases, only the foot of the column was rotted and much inconvenience and some money can be saved by the method explained here.

How the load was taken from a rotted column foot to enable its repair



Editor's Note: A reader has brought to our attention the fact that the pressure tap described by Joseph Allerton on p. 116 of our June 1945 issue was developed by Chester P. Baker and Albert J. Komich of Northeastern University and was described by them in *Ind. Eng. Chem. Anal. Ed.*, 9, 533, 1937.

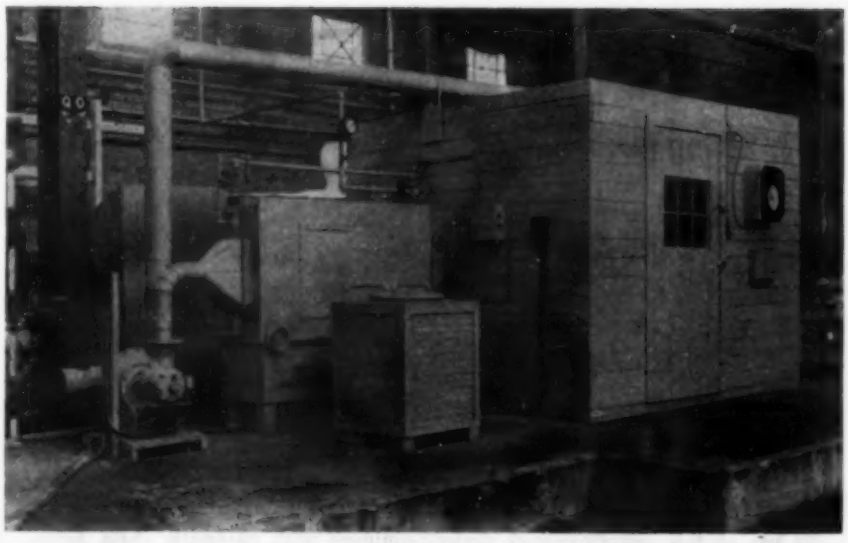


Fig. 1—Exterior view of air conditioned room for exposure tests of fertilizer

AIR CONDITIONED ROOM FOR EXPOSURE TESTS

JOHN E. CHENEVEY
Tennessee Valley Authority
Wilson Dam, Ala.

AN AIR CONDITIONED ROOM (Fig. 1) described below was constructed from salvaged material and equipment on hand for the purpose of testing the behavior of large samples of fertilizer materials under humid conditions. When the required range of temperature and humidity is not extensive, satisfactory results can be obtained with this type of equipment, which can be built cheaply and quickly.

The equipment is shown diagrammatically in Fig. 2. The exposure room, 8 x 9½ x 7 ft. high, is constructed of wood with double walls. Two tiers of six exposure trays each, with a 6-in. vertical clearance between the trays, are located in one end of the room, with a 12-in. clearance between the trays and the walls. The trays are 24 x 24 x 6 in. deep and can be manipulated as drawers through doors in the end of the room. Conditioned air enters the room through an 8-in. duct at the end opposite the trays. The two wooden baffles promote uniform distribution of the air. A 7-in. vertical exit air duct is located between the two tiers of trays, with openings distributed over its entire length.

Either fresh or recycled air is supplied to an air washer by a blower at a rate of about 400 c.f.m. The air washer (of steel) is 1½ x 5 x 4 ft. high. Water is sprayed into the chamber through six spray nozzles at a rate of about 10 g.p.m. at 20 lb. per sq.in. pressure. Conventional louvers and zig-zag spray eliminators of galvanized iron are provided. Low pressure steam is used in the heaters, which were constructed from the cores of small unit heaters, for controlling temperature and humidity. The steam flow is controlled by solenoid valves that are actuated by wet- and dry-bulb thermoregulators located in the exposure room. A fan provides a current of air over the wet bulb.

When the wet-bulb temperature in the room drops, the thermoregulator opens the solenoid valve that admits steam to the inlet air heater. This increases the evaporation of water and increases the humidity. Similarly, the dry-bulb thermoregulator controls the humidified air heater.

This room was operated continuously for several months at 80 deg. F. and 80 percent relative humidity (75 deg. F. wet-bulb temperature) with a variation of ± 1 deg. F. and ± 1 percent relative humidity. For humidities higher than 80 percent, live steam was added to the air stream ahead of the sprays. During hot, humid weather the spray water was cooled by means of an ice bath, which reduced the air temperature about 5 deg. F., with an ice consumption of about 75 lb. per hour. During hot weather the room was operated satisfactorily at 86 deg. F. and 75 percent relative humidity (79.5 deg. F. wet-bulb temperature) with ice-cooling. Tests indicated that the distribution of air flow over the trays was uniform.

It is estimated that this equipment can be used to maintain dry-bulb temperature varying from about 5 deg. F. below ambient temperatures to 100 deg. F., with relative humidities up to 100 percent. No appreciable dehumidification can be accomplished with this equipment.

Fig. 2—Plan and elevation of home-made air conditioning equipment

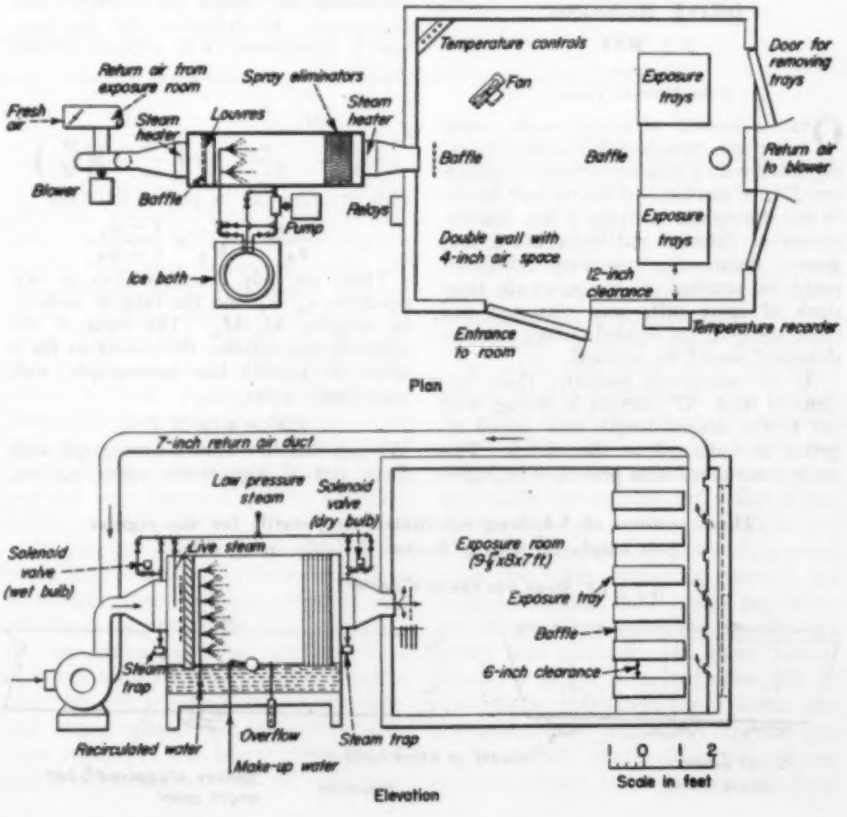


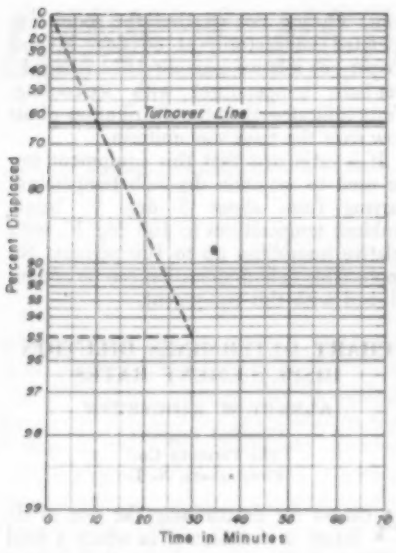
CHART DETERMINES DILUTION DISPLACEMENT RATES

ALBERT W. KINGSBURY
Chemical Engineer
The Permutit Co.
Birmingham, N. J.

A CHART for determining the rate of dilution in a container in which a fluid mixture is allowed to escape at the same rate as the diluting medium is admitted can be made with a sheet of semilog paper.

The position of the indicated turnover line (corresponding to what is generally called the nominal holding time) is determined by the fact that the same percentage of displacement (63.2 percent) is obtained with a single turnover regardless of the time required. (For theory see Ham & Coe, *Chem. & Met.*, 19, 1918, p. 663; also MacMullin and Weber, Trans. A.I.Ch.E., June 1935.—Editor.)

To illustrate the use of the chart, determine the amount of dilution taking place in 30 min. in a 100-gal. vessel if the influent rate is 10 g.p.m. The turnover or nominal holding time is then 100 ÷ 10 or



Dilution displacement rates may be determined with this chart

10 min. With a straight edge, connect the upper left hand corner of the chart with the 10-min. point on the turnover line. Continue with the straight edge to the point of intersection with the 30-min. line and then run horizontally to the left hand margin, reading the displacement, 95 percent.

By reversing the procedure, the dilution rate can be determined if the required displacement in a given time is known.

The chart may be extended in either direction in order to use longer time periods or dilutions in excess of 99 percent.

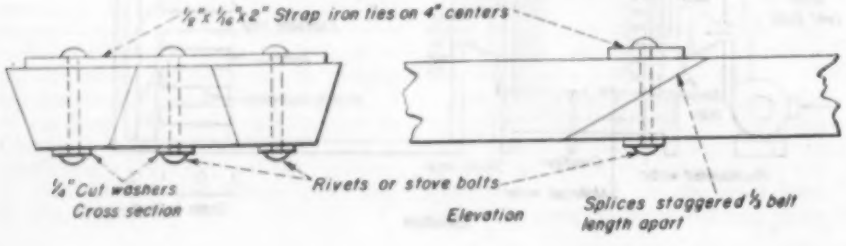
TEMPORARY REPAIR KEEPS DRIVE RUNNING

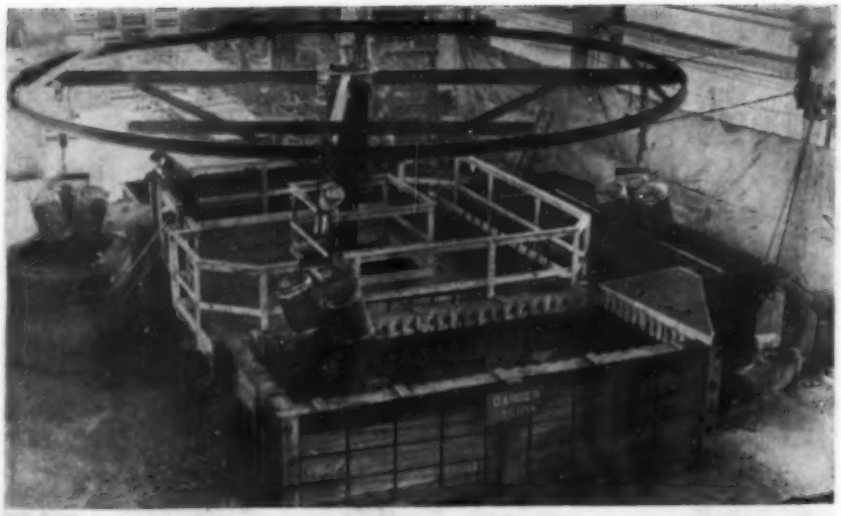
J. A. MAY
Engineer
Lake Jackson, Texas

OVER A PERIOD of several weeks, some time ago, considerable trouble was experienced with a number of Reeves variable speed drive mechanisms due to belt failure in an atmosphere carrying a low concentration of chlorine and hydrochloric acid gases. Before the operating conditions could be rectified, a comparatively large stock of spare belts was exhausted and more were to be needed before another shipment would be received.

As an emergency measure, three sections of used "C" section V-belting were cut to the desired length and spliced together as indicated in the sketch. This easily constructed item proved to be highly satisfactory and is suggested as a possible solution to the problem for anyone confronted with a similar situation.

Three sections of V-belting substituted temporarily for the regular belt employed with a Reeves variable speed drive





By use of this merry-go-round device, equipped with automatic chain hoists, Herman Franck, plant manager of the Dunkirk plant of American Locomotive Co. found a simple means for treating steel pressure tanks. The tanks are first submerged in an acid bath, then in a neutralizing solution, finally in water. The last stage is a drying oven. With about ten minutes per step, the device turns out about 18 tanks per hour. The scheme should have other possibilities

MOL-WEIGHT FRACTION CONVERSION CHART

MELVIN NORD
Chemical Engineer
Matawan, N. J.

CONVERSION of mol fraction to weight fraction of binary systems may be accomplished by means of a single line nomograph. By definition, the mol fraction of component A in a binary system is:

$$x_A = \frac{\frac{w_A}{M_A}}{\frac{w_A}{M_A} + \frac{1 - w_A}{M_B}} = \frac{1}{1 + \left(\frac{1 - w_A}{w_A}\right)\left(\frac{M_A}{M_B}\right)}.$$

This equation can be put in the form

$$\frac{1 - x_A}{x_A} = \frac{M_A}{M_B} \times \frac{1 - w_A}{w_B}.$$

There are only three variables in this equation, x_A, w_A, and the ratio of molecular weights, M_A/M_B. The form of the equation also satisfies the condition for a three-line parallel line nomograph, with logarithmic scales, i.e.,

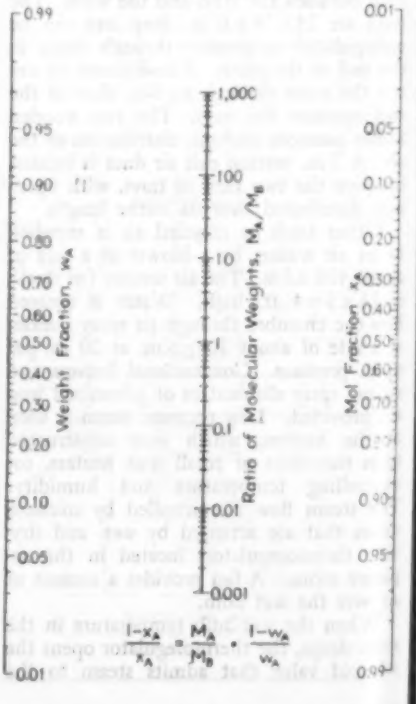
$$f(x) = \phi(y) \times \psi(z).$$

We can therefore draw a nomograph with three vertical logarithmic scales x_A, w_A, and M_A/M_B. This has been done in the accompanying figure.

It will be noticed that the range of x_A and w_A is from 0.01 to 0.99, which is sufficient for practically all purposes.

The advantages of the single line nomograph are its simplicity and its ease and speed in use. In addition, its symmetry makes it possible to go from mol fraction to weight fraction or vice versa. Furthermore, for a given system, M_A/M_B will be fixed, and hence the point on the center scale will be fixed. It is then possible to pivot on this point and run off any number of conversions.

Nomograph for mol fraction-weight fraction conversions



REPORT ON.....

INDUSTRIAL WASTE

An Important Factor in Process Planning

In tracing the industrial history of America, the process industries stand out for their progressiveness, ingenuity, and efficiency. Conversely, by failing to treat its wastes, industry has contributed to the degradation of the nation's streams and waterways. Realizing the importance of this problem, *Chem. & Met.* back in 1931 devoted a special issue to waste treatment and disposal, and warned the process industries that they must take action to prevent further pollution. After nearly 15 years, however, conditions have not improved, rather, they have become more aggravated than ever due to war activity. Significantly, public clamor for clean streams has forced anti-pollution legislation to a number one spot for postwar action. The purpose of this report is to emphasize the importance of waste treatment, in view of the trends in legislation, and to outline some of the methods employed.

Waste utilization has long been recognized as an important factor in the economics of the process industries. Waste disposal, on the other hand, has received far too little attention with the consequence that pollution effects of industrial waste have increased tremendously over the years. War, of course, has accentuated the waste problem. Economy and, in some cases, process efficiency have been neglected in the battle for all-out production of vital war materials, to the end that waste has increased with little effort available to attempt solution of the many problems.

As a result, the effects of pollution have multiplied and have become more significant than ever in the light of renewed activity by various anti-pollution groups (local, state, and national), which have focused public attention on this subject. Simultaneous action on the part of different legislative bodies for the abatement of stream pollution is a sure sign that the common practice of indiscriminately dumping untreated waste material into streams and waterways will eventually be curtailed. Without a doubt, as war production subsides, industry will be under pressure, greater than ever before, to tackle this job with new vigor and intensity. Already, many industrial plants throughout the country have been required to develop and build waste treatment facilities in an effort to meet government regulations. Industrial waste disposal, which 15 years ago was found only in a few scattered process plants, today has become a major problem, and tomorrow will be an established part of industrial planning.

In the face of the growing need for waste treatment and pollution control it is obvious that chemical engineers and executives must give this phase of industrial processing more and more attention. It is not a simple subject, but a complex one that will require the same ingenuity and resourcefulness that have successfully been applied to the knotty problems of wartime production. The fact that by-products may not always result from treating industrial waste should not deter this activity. Waste treatment for the simple purpose of preventing nuisances and harmful pollution must be incentive enough for industry to devote some of its best research talent to this problem.

Although industrial wastes include liquids, solids and gases, it is the liquid waste (usually containing a large portion of solids) which has attracted widespread attention because it has shared with municipal sewage and mining waste the responsibility for creating the polluted condition of many streams and waterways. The load of polluting material imposed upon the water courses of America has increased steadily, due to both population and industrial expansion and has menaced greatly the usefulness of these natural resources. It has been, and often still is, the custom to discharge liquid wastes into the nearest water course with little thought to its ultimate effect. This was entirely justified during early days of industrial

Sedimentation tanks for recovering fiber from paper mill white water

expansion, since the relative volume of waste was small enough to be easily assimilated. Now, however, especially in congested areas, pollution has increased to the point where stream utility has been greatly diminished.

Perhaps the wide functional utility of streams and other bodies of water has made for a keener appreciation of the need for pollution abatement. Some of these functions include public health (domestic water supply), drainage, navigation, industry (water supply, water power, etc.), and recreation, none of which can be utilized primarily to the exclusion of the others. It is this over-all usefulness that has caused many public-minded groups to promote anti-pollution activities, and since public action is the driving force behind any movement toward pollution abatement, it might be well to examine the trends in legislation.

STATE REGULATION

In the past, most government regulation of water pollution has been under authority of state laws. While all states have statutes they are by no means uniform, neither in provisions nor effectiveness, which, of course, is quite natural since local conditions within various states differ considerably. The major objective of most state legislation is public health, but some laws include protection of aquatic life, shellfish, industrial water supply, and recreational areas. Many of these laws are not adequate and could be improved by providing adequate authority to determine pollution standards. That this situation is well recognized is shown by the fact that over half of the states have bills before their respective legislative bodies at the present time in an effort to strengthen their anti-pollution laws. Certain states, however, are already refusing permission for new plants to start up unless waste treatment is provided.

Until recent years most neglected of the water pollution areas have been the heavily polluted streams flowing through more than one state. Here individual action usually proves ineffective since all states in the drainage system contribute to the pollution and should all cooperate in its abatement. Interstate agreements have in some cases done much to improve the situation by bringing the states together in a program of mutual satisfaction.

Among these is the Interstate Sanitary Commission, established through a compact between New York, New Jersey and Connecticut, which governs the pollution of the New York Harbor and adjacent waters. This compact or interstate treaty was adopted by the states and approved by Congress. Authority is vested in the commission to set up and enforce standards of abatement.

A second type of agreement exists for the the Delaware River between Delaware, Pennsylvania, New Jersey and New York. This provides for a commission which recommends a common policy for abatement to be effected through regulation by each of the states. In this case actual enforcement remains with the states.

Other interstate agreements are either in effect or projected for several other watersheds including the Potomac, Ohio, and Red Rivers.

Congressional interest in federal legislation for stream pollution control led in 1934 to appointment of a committee to draft plans for legislative action. This committee, however, failed to reach agreement and brought forth two separate reports. The essential point of difference between the two approaches to the problem is that one provides for federal leadership and aid to state authority, while the other proposes actual federal authority and responsibility to prevent pollution. At that time, and in subsequent years, various bills expressing these viewpoints have been introduced before Congress and in 1938 a bill, HR-2711, was passed but was vetoed by the President on technical grounds. This bill provided for cooperation between states and federal government in regional planning, for federal aid in study and development of plans for pollution abatement, and for loans or grants-in-aid in construction of treatment works.

FEDERAL LEGISLATION

Three bills have been introduced and are now awaiting action. While these bills all include the general provisions outlined above, they differ in several respects, primarily with regard to control responsibility, enforcement, and establishment of standards.

HR-592 is of the "study type" generally favored by industry, and is consistent in principle with the bill vetoed in 1938, but eliminates points of objection which called for its veto at that time. This bill establishes responsibility and duties relating to water pollution control in the sanitary engineering division of the Office of the Surgeon General of the United States Public Health Service, and enforcement consists of recommendations to the proper state authorities for remedial measures to be taken. No provision is made for the establishment of sanitary water districts and purity standards.

HR-519 (companion Bill S-535) is sponsored by the Isaak Walton League and provides strict government authority for pollution control. Responsibility lies in a national board of water pollution control consisting of several cabinet members and Congress members. An operating commission of nine members from various federal agencies is directed to classify the navigable waters of the United States into sanitary water districts and to fix standards of cleanliness and minimum treatment requirements. Provision is made for the allowance of no new sources of pollution and definite time limits are set (which may be extended for cause) for abatement action to be instituted on existing pollution. Finally, enforcement consists of action by the U. S. attorney at the request of the board only after such existing state or interstate agencies have been given a full opportunity and failed to correct a given situation.

HR-587 (companion Bill S-330) is, in effect, a combination or compromise of the two preceding bills. This places administration under a division of water pollution control of the United States Public Health Service rather than under an inter-department Congressional board and fixes standards of water quality. Enforcement of pollution abatement is the duty of the appropriate U. S. district attorney.

These bills which are before Congress must now be acted upon during the 79th Congress or they will automatically expire and must be reintroduced in a subsequent Congress to be further considered.

Regardless of the outcome of present pending legislation, it is almost certain that some kind of organized federal participation in anti-pollution work will be forthcoming. Much of the agitation for federal control has arisen from the inability of the states to handle the problem adequately. And even though many states and interstate groups are intensifying their effort, it is not likely that results will offset the pressure for federal action.

With more stringent regulations virtually assured, and with activity in the form of planning, surveys, and actual anti-pollution campaigns going on throughout the country, what will be the effects on established industry? Already responding to this pressure, many municipalities have built sewage treatment works and many more are being planned as immediate postwar projects. Since sewage treatment is a fairly well established procedure and since there is a favorable outlook for government financial aid, it will be only a matter of time until most communities of any size will have treatment facilities. Undoubtedly, this alone will provide a tremendous stimulus toward forcing industry to clean up its waste, for when public funds are spent to protect the natural resources of a community it is certain that damage from any other source will be firmly opposed. No longer can industry rely on public apathy to allow them to ignore this problem.

MANAGEMENT'S PROBLEM

It is therefore increasingly evident that waste treatment and disposal must be given high priority on the agenda of postwar projects. A new concept of the importance of this subject must be adopted by management, not only from the standpoint of public relations, but from the point of industry planning, process design and economy.

First of all, waste disposal must be considered an integral factor of industrial planning. It has an important bearing on plant location and must be figured in cost estimates in the same manner as water supply, power costs, taxes, transportation, labor, etc. Consideration must be given to future industrial development that might tend to change the existing regulations in a given area. The tendency for industry to locate new plants in rural areas to avoid many of the disadvantages of congested centers should be countered by a realization that new industries bring new conditions which often influence future laws and regulations.

Second, waste treatment should be recognized as a necessary plant process and should be given the same study and research accorded actual production methods. Fundamental research, pilot plant and process design, should be carried out to assure the best and most economical methods of treatment consistent with local regulations. Actually these problems will never be satisfactorily solved until they are handled on the same sound engineering and economic basis which is the foundation of the process industries.

Third, the concept that utilization removes all objectionable waste is erroneous. Naturally, the recovery and profitable utilization of objectionable waste is desirable, but often these processes produce new wastes which still require treatment. Utilization research is, in reality, product research in which the aim is to develop a new product and thereby eliminate objectionable waste. But it seldom works out this way, and there are many cases on record where large sums of money were spent on waste utilization but still resulted in an untreated objectionable waste discharge. Although recovery of valuable material is sometimes effected and is a definite economic asset, few industries can expect to benefit directly from improving the quality of waste discharge from their plants. Industrial waste treatment cannot be expected to pay a net return, but, rather, must be regarded as a charge on the cost of production.

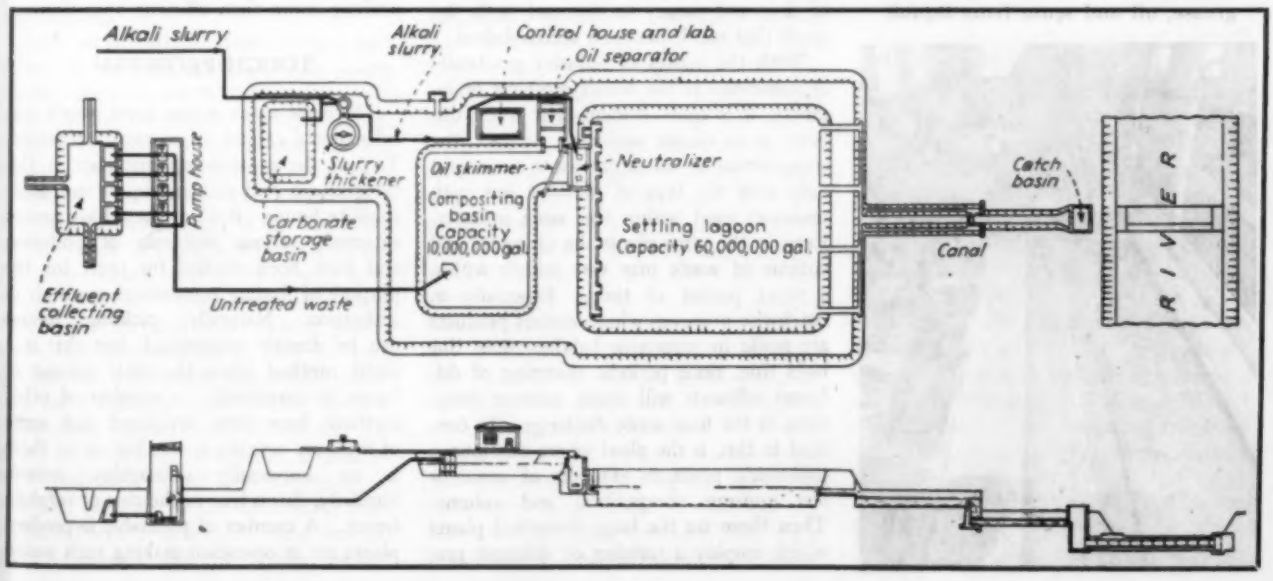
Nevertheless, in any practical approach, the first step should be to waste less of the raw material, intermediate and final product. Then, waste material should be examined to determine if economic utilization is in any way possible. Finally the remaining waste should be treated to the necessary standards in the most economical manner possible.

INDUSTRY COOPERATES

That industry is becoming increasingly aware of its responsibility along these lines is evident in that several industry-wide groups are now carrying out programs of research and development on both waste utilization and pollution abatement, and are setting a pattern which may well be followed by other chemical process industries.

Outstanding in this activity is the National Council for Stream Improvement, formed by the pulp, paper and paper board industry. This industry, since it has some of the most difficult of waste disposal problems, has long been a leader in this work, through both individual and group organizations. Recognizing the need for more integrated effort along these lines, the National Council was organized in 1943 for the purpose of coordinating industry-wide activity and for the promotion of greater cooperation between individual

Plan and elevation of an effluent treatment plant handling the waste from several hundred different chemicals



members in attempting to solve common problems. Financed by an equitable system of membership assessments, it has already sponsored a research fellowship at Mellon Institute and will follow this with similar programs at other institutions.

Far-reaching in its service to the industry is one project which will consist of a sanitary analysis of all the watersheds in the country for the purpose of determining the pulp and paper industry's responsibility for existing stream conditions as related to the responsibility of other industries and municipalities. This will not only aid individual plants but will mean a real help to existing authorities in the establishment of equitable regulations.

Besides coordinating and carrying on research and investigational activities, the National Council provides various services to its members, including technical and engineering assistance, distribution of information and reports on legislation. All in all, the work carried out by this organization will help not only its members, but will render invaluable service to industry and the country as a whole.

OTHERS, TOO

Various other industry-wide organizations have also carried on similar work. The American Petroleum Institute, about 15 years ago, realizing the need for more effective pollution control, established committees on waste disposal for the several branches of the industry to coordinate the efforts of individual members. Through a high degree of cooperation and participation many of the waste disposal problems were solved and resulted in the publication of several booklets outlining the recommended methods of treating petroleum wastes.

Research directed by the Committee on Disposal of Refinery Waste has continued to be carried on in laboratories of many refineries, the results of which have helped the petroleum industry to maintain its reputation for efficiency, resourcefulness and progressiveness.

Several years ago the American Iron & Steel Institute through its Committee on Industrial Waste began active work to focus the efforts of this industry toward development of a technically and economically satisfactory process for treatment of waste pickling liquors. As old as the steel industry itself, this has been a major problem in stream pollution. Since 1938, an industrial fellowship has been maintained at the Mellon Institute for the purpose of studying all phases of this problem and to date many byproduct recovery processes have been studied and evaluated. While no completely satisfactory disposal or utilization method has yet been arrived at, undoubtedly, if these studies continue this problem will eventually be solved.

Other industry-wide organizations which have been interested in waste-disposal work for their individual industries include the Textile Foundation, the National Canners Association, the Tanners Council of America, the Institute of American Meat Packers and the National Dairy Council. While some of these are more active than others, they have all contributed a share in helping their respective industries to do a better job in salvaging and utilizing waste products, and in furthering the cause of pollution abatement.

Obviously, the farsighted leaders who have helped organize and carry on the work of these agencies, have realized the necessity for pollution abatement. It is apparent too, that utilization and recovery of waste material, where economically possible, is very desirable and should be the first step in any program to prevent pollution. In fact, waste prevention and recovery is so essential to efficient and economic operation that most plants in competitive industry have devoted a good deal of time and money to this end, with the result that much has been accomplished.

Skimming device for separating grease, oil and scum from liquids

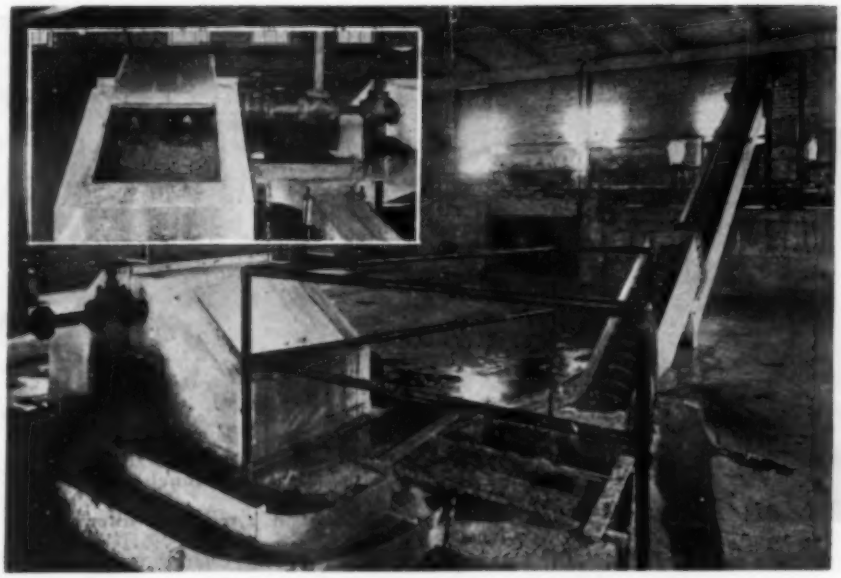
With the wastes of industry practically as numerous as the actual products of industry, it is quite evident that waste disposal is no simple problem. In fact, the composition of industrial waste varies not only with the type of industry but with processes used within the same industry. Even in the same plants the character and volume of waste may vary widely within a short period of time. Especially in batchwise processes where various products are made in successive batches, does this hold true, since periodic dumping of different effluents will cause extreme variations in the final waste discharge. In contrast to this, is the plant where continuous processing produces effluents of more or less uniform composition and volume. Then there are the large diversified plants which employ a number of different processes both batch and continuous with a correspondingly wide variety of wastes. Clearly, then, each plant and process must be studied separately and individuallv to obtain a true evaluation of the problem.

There are two general types of waste material from industrial processes: those from which useful material or products may be salvaged or recovered, and those which apparently have no value and must be disposed of. However, there are no hard and fast rules—many factors enter into the picture and often only a very fine line separates the two. The answer to whether or not a given waste may be salvaged is determined by two major factors: the technological processes available to recover or manufacture byproducts and the economic possibilities for profitable operation, both closely related.

Often, however, recovery of useful materials does not require elaborate treatment, and there are many plants where this is not considered waste recovery at all, but rather a part of an over-all efficient operation to prevent waste. Most modern processing plants sample all effluent lines several times a day to guard against loss of valuable raw materials, and so maintain a constant check on plant efficiency. An example of this is the pulp and paper industry, which, by use of various types of filters and savealls, prevent waste of valuable fiber. The petroleum industry which in the past has lost large quantities of oil in waste water, now recovers a large portion of this by use of efficient separators. Many other industries such as synthetic rubber and glue manufacturers have accomplished similar results. The value of recovery within the plant is that the salvaged material can go right back into the process. Of course, some materials cannot go back into the process, but these may often be sold as raw materials for other processes. Regardless of how they may finally be used, the fact remains that salvaged material and waste prevention is nothing more than efficient operation.

TOUGH PROBLEMS

There are many wastes from which useful material cannot be so easily recovered. Two of the outstanding materials in this category are acid pickling liquor and waste sulphite liquor. Both of these have caused extremely serious problems of pollution and have been studied for years for the purpose of finding economical methods in utilization. Naturally, pickling liquors can be directly neutralized, but this is a costly method when the total volume of liquor is considered. A number of other methods have been developed and some of these are actually in use, but so far there is no universally satisfactory answer. Similarly, this is true in the case of sulphite liquor. A number of profitable byproduct plants are in operation making such varied



Rotary screens and inclined dewatering screw conveyor for recovery of glue stock from waste water. Inset shows screen and washing sprays

products as synthetic vanilla (over one-half of the U. S. supply from this source), tanning agents, boiler water treatment compounds, adhesives, road binders, lignin plastics, alcohol and others. However, economic factors enter strongly—for instance, in Sweden over 30 plants are making alcohol from waste sulphite liquor economically, but normally in this country plenty of alcohol production is available from molasses and surplus grain, so the economy of alcohol produced from sulphite liquor is questionable. At the present time, for all the possible and existing byproducts, a large part of the total sulphite liquor now produced is wasted. Similar problems exist in many process industries where no economical utilization of wastes appear to be available. On the other hand, industrial history is full of examples where efforts at utilization have resulted in byproducts equal in value to the original product from which the waste was utilized.

After all recoverable materials have been removed, the final waste effluents usually contain material which causes water pollution. These are usually liquids with the waste material in dilute solution or suspension, and it is partly due to this dilute condition that recovery or utilization is economically impossible. While the actual concentration of many waste effluents may be comparatively small, the effects on a stream or body of water may be to cause considerable damage. For instance, phenol waste at a concentration of only 0.1 parts per million will render unpalatable otherwise good drinking water; where water is chlorinated, 5 parts per billion will impart a chlorophenol taste which is distasteful. Relatively small concentrations of coal silt, or culm, in the wash water from collieries over a period of years has deposited enough silt to render certain streams unfit for recreation and navigation. These are some of the industrial wastes, which play an important part in a stream pollution. A better understanding of waste characteristics, their effects on stream and water pollution, and the methods and equipment for their treatment will bring a better understanding of this problem.

Industrial waste may be classified, in a general way, according to predominating characteristics, as organic, toxic, and inert. Especially in the chemical industries, the effluent from a single plant may contain elements of all three. However, many industries produce waste which predominantly fall into a single class.

TYPES OF WASTES

Organic waste (domestic sewage falls in this class) originates from a number of industries including the following: dairy, beet and cane sugar, starch, breweries and distilleries, laundries, canneries, textiles, pulp and paper, glue and gelatin, meat packing and others. As noted they are ordinarily of vegetable or animal origin, and are characterized by their content of fatty, nitrogenous and carbonaceous material which are highly putrecible causing obnoxious odors. This type of waste usually consists of a great many unstable compounds which have a strong tendency to break down into simpler, more stable forms, and this decomposition is normally brought about by the action of oxygen and aerobic bacteria. These bacteria or organizms consume the organic solids, and combine them with oxygen in a process known as biological decomposition. Actually, oxygen is the vital element for the biological decomposition of organic waste. If the oxygen in a stream is sufficient for this act, stable final products will result in a process of natural stream purification. However, if any excess of organic material is continuously dumped into the stream the dissolved oxygen in the water will be depleted; anaerobic organisms will then act directly on the organic material and instead of forming carbon dioxide, water and other stable compounds, the action will result in the production of such obnoxious compounds as methane, hydrogen sulphide, ammonia and others having little or no oxygen.

It is easy to see, then, that where gross pollution occurs the oxygen is used up and the many forms of aquatic life which require oxygen will die including fish, shellfish and various forms of vegetation.

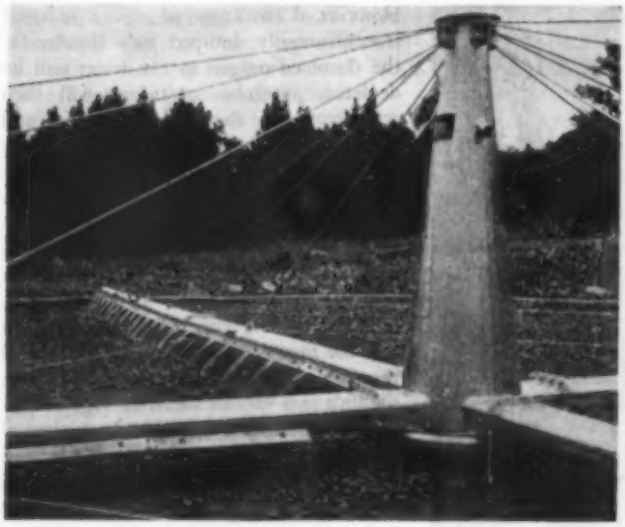
Streams can be regarded as biological and chemical treatment plants of limited capacity, which must purify any unstable waste received from any source. Since the water of an unpolluted stream is ordinarily saturated with oxygen obtained from the air and aquatic plants, it can take care of waste material up to its capacity. Whenever the available oxygen, however, in a stream is exceeded by the oxygen demand of organic waste, a septic condition is brought about where odors are evolved, aquatic life is killed and the stream is made unfit for consumption or recreation.

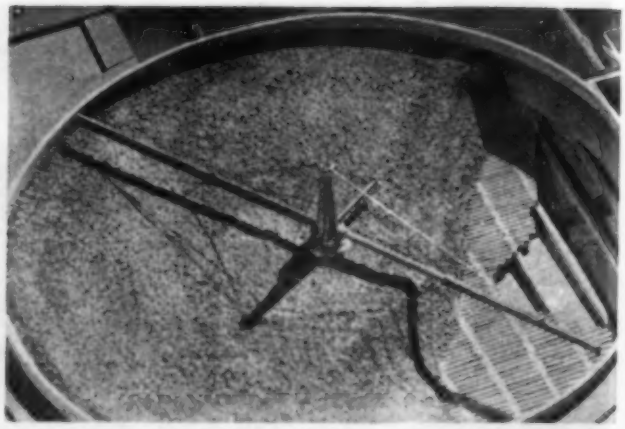
CHEMICALS

Toxic waste consists mainly of active chemical compounds such as acids, alkalis and oxidizable compounds including phenol, cyanide and similar substances. This class of waste material comes from chemical plants of all kinds as well as from such processes as acid pickling of metals, metal plating, wool scouring, dye manufacturing, soap, byproduct coke, TNT manufacture, oil refinery waste and many others. It is these wastes that are responsible for most of the discoloration, odors and tastes in otherwise potable water supplies. Many of these are toxic to aquatic life, and to the organisms which accomplish stream purification.

Inert wastes usually consist of insoluble substances in high concentrations such as culm and silt from coal mines, lime sludge from various chemical processes, sawdust, and includes oils, tars and sludges from the petroleum industry. Insoluble solids are principally objectionable because they deposit on stream beds destroying plant life and eliminating the spawning grounds of fish. Navigable waters fill up and must be periodically redredged, while recreational waters are made unsightly and unattractive. Although oils are generally chemically inactive, they are very harmful since they float on the surface. Oil slick destroys recreational areas and tends to prevent reoxygenation of the water, thereby impeding organic purification, and lowering the quantity of oxygen available for fish life.

All in all, the sources of pollution are





Above—Cutaway view of a trickling filter showing stone section and tile base with drainage channels underneath

Left—Sprinkling mechanism on a trickling filter

many, and include practically all of the process industries. For many of these wastes, adequate treatment methods have been worked out, but many new wastes for which treatment studies have not been made, have resulted from the vast number of new and modified industries developed during the war. Even in industries where treatment processes are established, various combinations of methods and equipment may accomplish a given purpose, and in every case it is necessary to carefully select the best combination of equipment to achieve the desired results.

METHODS AND EQUIPMENT

A study of methods and equipment used in modern industrial waste treatment practice brings out some interesting points. It becomes apparent that most unit operations used are well-known to all chemical engineers and are not unique to waste treatment processes. Furthermore, the process of biological treatment, formerly used prinicpally in sewage disposal, is rapidly becoming a more important tool to those chemical engineers who are handling organic industrial waste problems. Types and makes of equipment too, are the same familiar ones used throughout the process industries. In the main, however, no great advances have occurred in the design of equipment used in this field; rather, successful application has been due to improved methods and new concepts of how to treat and process industrial waste. Perhaps the most significant improvements in equipment have been from the standpoint of materials of construction in which new corrosion resistant materials have undoubtedly played an important part in providing better and more economical means of handling and processing waste materials.

In discussing methods and equipment, no attempt is made to give details of operation, since these are well known to most chemical engineers. The purpose is, rather, to outline broadly the more important unit operations and how they are applied. However, many of these methods, especially where organic wastes are treated, have been adapted from sewage treatment practice and it must be remembered, too, that many plants (not located in a municipality which has a sewer system), especially those with a large number of employees, must design their processes to handle not only industrial waste but sanitary sewage as well.

Three principal types of processes are used in waste treatment namely, mechanical, chemical and biological. While there are certain isolated instances where only one of these methods might be required, such as in the pretreatment of waste prior to discharge into a municipal sewer, it must be emphasized that most waste treatment requires a combination of the three methods to do the job. In almost every case there is more than one way to accomplish satisfactory results, but any process selected is made up of a combination of these unit operations and equipment.

MECHANICAL TREATMENT

In mechanical treatment many common unit operations are employed and while generally they are for the purpose of separating components of the waste, their applications differ considerably.

Screening.—This is usually a preliminary treatment for all waste effluents. Coarse screens are used to remove any bulky solids that may be present, including sticks, rags, paper and other similar material for the purpose of protecting subsequent equipment such as pumps, and to prevent plugging of pipe lines. Both mechanically and manually cleaned bar screens give satisfactory service.

Fine screens are for the purpose of removing floating or suspended solids and aid in recovery of valuable material such as rubber crumbs, agglomerated glue stock, pulp fiber, etc. They are employed considerably in the canning industry for removing pea pods, tomato skins, and similar wastes from the effluent. Fine screens may be of the rotary type, either with fine mesh wire or slotted plates. Inclined vibrating screens are also used extensively.

Sedimentation.—This operation is almost universally used in both sewage treatment and industrial waste disposal and is employed to separate fine suspended solids from the liquid by allowing the solids to settle to the bottom, leaving a clear supernatent solution. Sedimentation tanks, commonly known as clarifiers or thickeners, may be of two general types. The intermittently operated tank is cleaned manually but is not used very extensively. In the continuous sedimentation tank the solids are continuously removed by any one of several mechanisms. These tanks may be circular, square, or rectangular, and may use sweeping devices or rakes which move the solids to a point of discharge where the sludge is removed with a pump. Another device for removing sludge is a suction nozzle, which is continuously moved across the bottom of the tank. Certain types have skimming devices. Sedimentation tanks may vary greatly in size and a number of them may be used at different stages of treatment. Chemical treatment, (flocculation, discussed below) may often be used to aid this separation.

Gravity separation of liquid-liquid mixtures such as oil and water are accomplished in various ways. Oil recovery is most effectively handled by a gravity separator, developed under direction of the American Petroleum Institute, consisting of settling tanks with both skimming and sludge removal mechanisms.

Filtration.—Nearly always preceded by sedimentation, filtration is used for two purposes—to further clarify or "polish" an effluent and to dewater sludges.

Clarifying or polishing the effluent is often the last step in the process prior to chlorination and ultimate discharge and

usually is accomplished by means of sand filters (sometimes operating under pressure) which are cleaned at frequent intervals by back washing. Quite similar to the sand filter is the coal filter which is frequently used today. This is built up of layers of different sized coal in the same manner as the sand filter and is reported to be more efficient and to require a less frequent back washing interval than the sand filter, thus using less wash water. Wash water is recycled back into the sedimentation tank and through the system.

Dewatering filters reduce the water content of sludges and solid material. These are of two types—pressure filters, which are usually intermittently operated, and continuously operated vacuum filters. Most of the commercial filters available on the market may be used for this service, depending on the type of sludge or the particular requirements of an individual plant.

Centrifuging.—Both batch and continuous centrifuges may be used in dewatering certain sludges. Some slimy materials which require filter aids and precoats on other types of filters can often be handled more economically by this method.

SEPARATION

Flotation.—Flotation, with or without the use of flotation agents, (either at atmospheric pressure or under a vacuum) is used frequently in treating industrial waste for the removal of fine unsettleable solids. There are several types of flotation units. One type of unit is used for such light, fine, unsettleable solids as the fiber in paper mill white water and consists of aearation with or without flotation agents such as glue, rosin or alum. The fine solids float to the top and are removed continuously. A similar unit operates under vacuum which causes air to come out of solution to float the solid particles to the surface.

Another unit for similar application uses an upflowing feed without aeration, with or without flotation agents, in which a layer of sludge or a suspended "sludge blanket" is maintained at the top. The upflowing solids attach themselves to the suspended sludge blanket, which is kept at the desired level by an internal device for continuously removing the collected solids.

A vacuum operated sedimentation tank has had considerable success in removing both greases and settleable solids and this has both a skimming device for removing the layer of material at the top and a sludge removing mechanism at the bottom.

Evaporation.—Two methods are used for removing liquids from solids in this type of operation. Solar evaporation from lagoons finds considerable application, especially as a temporary measure. This is not generally considered good practice. Lagoons often develop bad odors and must be treated with chemicals to prevent them from becoming nuisances.

In modern practice, evaporation is used where dissolved solids are high, since in this case it may be more economical than other methods. Any of the modern types of evaporators may be employed, depending on the particular product and the economics of investment and operation. A classic example of evaporation is in the kraft (sulphate) pulp recovery process, where black liquor is evaporated before being burned in a smelter where the ash is recovered. Distillery slop is also recovered by evaporation and is used for cattle feed and for the production of certain vitamins.

Adsorption.—While not a common method in waste treatment, activated carbon may be used to adsorb selectively certain organic chemicals such as phenol and phenol-like homologs in concentrations as high as 1,000 ppm. Other adsorbing agents may be employed in similar manner.

Drying.—After sludge is dewatered it may be dried prior to ultimate disposal. Two methods are commonly used—solar drying and artificial drying. Solar drying is simplest and cheapest where it is applicable and may take place in lagoons or in under-drained sand beds. In the latter method the sludge is applied in thin layers and moisture is removed by both evaporation and drainage.

Artificial drying may be accomplished in various types of dryers. Continuous rotary dryers are, perhaps, most used in sludge drying, but there are certain applications where spray drying is desirable.

Incineration.—This treatment is often used where the fuel value of the material is appreciable and the heat can be utilized, and especially where the ash has valuable components.

CHEMICAL METHODS

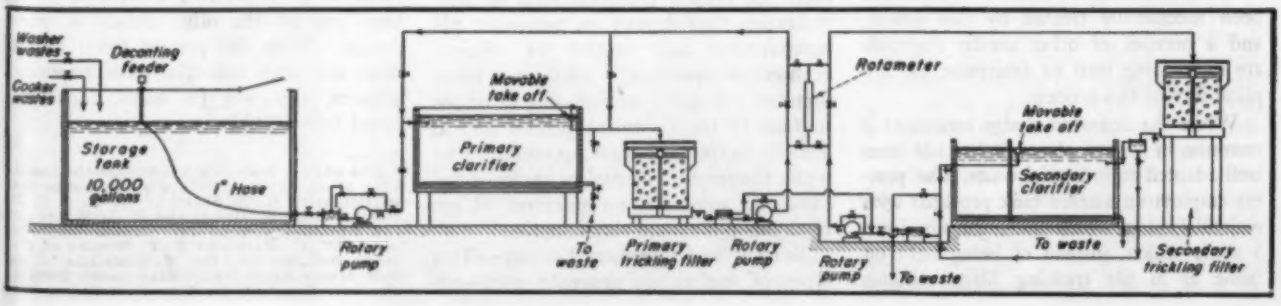
Treatment of sewage by certain chemical processes has long been practiced. Chemical wastes, especially, require chemical treatment for the purpose of nullifying the final effects of toxic pollution. (Actual equipment used in connection with these means of treatment are covered in a subsequent section.) The most important of these methods are given below.

Flocculation and Precipitation.—Flocculation is used extensively as an aid to settling and employs such chemicals as alum, ferric chloride, ferric sulphate, and sodium aluminate. Precipitation finds application in taking out of solution certain compounds which when precipitated will settle out and may be removed. Precipitation agents vary widely, depending on the actual material to be removed. Flotation agents help in floating suspended solids by forming an air bubble around the minute particles and thus elevating them to the surface. These include alum, rosin, glue, sulphonated oils, and others. Chemical agents for breaking oil emulsions are used to treat oil wastes.

Neutralization.—This is one of the most common methods of treating chemical wastes and is coming more and more into use in this field where acid and alkaline wastes are produced. Well established are the pH limits at which aquatic life is endangered and waste effluents must be kept well within those limits. In certain chemical plants where both acid and alkali wastes are produced, it is common practice to compound all wastes together in a storage pond with a retention time of about 24 hr. This gives the various components an opportunity to react with each other so that the final effluent will not only be more uniform in rate of outflow, but will require a minimum of corrective treatment.

Oxidation and Reduction.—While both

Flowsheet of a pilot plant for studying the effects and capacity of trickling filters on certain types of industrial waste. Note that the piping arrangement permits several different combinations of flow to be evaluated



of these methods are used, oxidation is by far the more common. Outstanding are the chlorination treatments which give final sterilization to liquid wastes. While chlorination definitely has its limits, it has been used successfully to oxidize various organic substances and compounds. Reduction methods are not as common as oxidation but are used to some extent in treating bleaching effluents where hypochlorite and other chlorine type bleaching is carried on, or where peroxides are present in waste liquor. Most important of the reducing agents is sulphur dioxide.

BIOLOGICAL TREATMENT

As pointed out in a preceding section, organic type wastes are subject to natural stream purification by means of bacteria and oxygen. This natural process of treating organic wastes was adapted long ago to sewage treatment work and has since been applied successfully to certain types of industrial wastes. Two types of treatment utilize, respectively, aerobic bacteria (requiring free oxygen and forming carbon dioxide and water) and anaerobic bacteria (carried on in absence of free oxygen so that the bacteria must act directly on the organic compounds forming gas—methane, hydrogen sulphide, etc.).

Aerobic.—This type of treatment is applied only to liquids from which suspended solids have been removed. A trickling filter (biological filter) is most common of the methods using aerobic organisms and consists of a bed of carefully sized stone several feet thick resting on porous tile, which, in turn are supported by concrete members. These form a grid pattern so that the liquid can flow freely through the tile and down the sloping floor under the grid to a drain where it is removed with a pump. A sprinkling device which rotates similarly to a lawn sprinkler by the reaction of its spray is usually used to spread the liquor evenly on the bed. Air passes freely between the stones which soon become covered with a slime containing the organisms. After the liquor passes through the trickling filter it is usually clarified and passes to a secondary trickling filter for further treatment. Partial recirculation is often used and various hookups may be applied in obtaining the best operation.

Trickling filters may be employed for a wide variety of organic wastes having solids in solution. Phenolic wastes have been successfully treated by this means, and a number of other similar materials are undergoing tests to determine the applicability of this process.

While the activated sludge treatment is common in sewage plants, it has not been well adapted to industrial waste. The process employs an aerated tank provided with recirculation in which the organisms form a slime which, instead of being held on stone as in the trickling filter, remains suspended and is in constant contact with the liquor. This method is subject to shock by irregularities in flow and quality, and generally is upset too easily for such variations found in most industrial waste.

Anaerobic.—Several processes are available utilizing anaerobic bacteria (which can be used on liquid or sludge) and again these were developed first for sewage treatment. A two-chamber combination sedimentation and sludge digestion tank, while used extensively for sewage, is not too commonly used for industrial waste.

Controlled temperature sludge digestion is often used to reduce organic sludges. Outstanding advantage of this process is that the gas produced can be used as fuel, which helps considerably in the economy of over-all plant operation.

While the unit operations and processes of industrial waste treatment have been covered there are several unit operations used in these processes which have no place in the general outline of treatment practice. The chemical treatment processes depend on certain of these, and materials handling equipment is integral with plant operation.

Materials Handling.—Waste treatment requirements in materials handling are usually similar to the requirements of other industrial processes. Materials here dealt with include liquids, slurrys, pulps, or dry solids. Where necessary, corrosion resisting equipment is generally available. Sludges are best handled by plunger or diaphragm pumps. Dry solids such as lime or alum may be handled by a number of common methods such as bucket elevators, conveyor belts, spiral conveyors, or even pneumatic conveying systems.

Mixing and Agitation.—These operations are frequently employed to obtain thorough mixing of chemicals or conditioning agents with the effluent, for precipitation, coagulation or neutralization. Various devices may be used including mixing flumes and paddle, impeller, and turbine type mixers.

Measurement and Control.—While industrial instrumentation does not find wide application in waste treatment, there are certain processes such as neutralization that depend on automatic pH measurement and control for efficient economical operation. Automatic measurement is useful in determining variations in flow to the treatment process and as a check on the total plant operation. Automatic temperature control of sludge digestion, and automatic measurement of gas from this process are also valuable.

Reagent and Chemical Feeding.—Two types of feeders are generally used—dry feeders and liquid feeders, which may be either volumetric or gravimetric. Dry feeders are used for such dry chemicals as alum and lime and any of the feeders on the market may be applicable. Liquid feeders of various kinds are used, including controlled volume pumps, gravity tanks, decanting systems, etc.

ENGINEER'S JOB

It should be apparent that many combinations of the methods and equipment discussed may be used to solve an industrial waste problem. The final selection of the best combination of methods and equipment is, however, based on technological and economic factors. There is no one best process for all plants, not even for similar plants, since many economic factors must be considered such as stream standards, initial cost of equipment, cost of chemicals, operation cost, maintenance, etc. Obviously, the job of designing the best, most economical treatment plant is no job for a novice, but requires experience and training in solving this kind of problem.

It is a job for a chemical engineer with special knowledge of the sanitary engineer's field, for there are certain fundamental aspects of the problem which demand more than straight chemical engineering knowledge. The plant wastes must be evaluated for quality and quantity under all possible operating conditions, both chemically and biologically. The receiving body of water must be studied to determine maximum and minimum flows and it must be analyzed for dissolved oxygen to determine its capacity for natural purification. The effect of industrial waste on the stream and its aquatic life must be ascertained.

Laws and regulations must be studied to determine what limits are put on the stream's use in so far as discharging wastes is concerned. If standards of pollution abatement have been set up, what are they and how do they affect an individual plant?

The problem of specific locality has a bearing on a given problem. Where a plant is located so that it must discharge its wastes to municipal sewers, it must comply with municipal regulations. Often only pretreatment of the waste is required, while some towns require no treatment.

All of these things must be studied and considered before thought is given to methods of treatment, equipment selection, and all the other details of plant design. With the present trend toward more and more industrial waste treatment projects, this will be unquestionably a broad field for chemical engineers.

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PROCESS EQUIPMENT NEWS

THEODORE R. OLIVE, Associate Editor

SILICA BLOCK

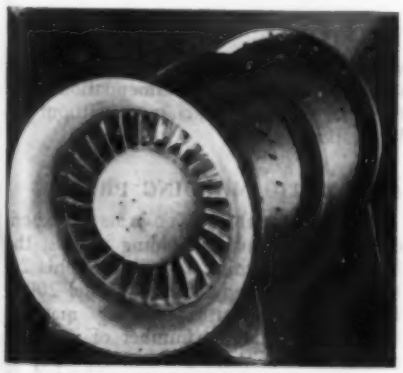
As an accessory to the installation of its Radiamatic radiation pyrometers for the measurement of crown temperatures in glass tanks, the Brown Instrument Co., Philadelphia, Pa., has developed a new silica block of single-hole design which is installed flush with the inside roof surface. It may also be installed with the bottom of the block extending into the furnace for several inches. A sillimanite target tube is installed in the block and the radiation pyrometer is then sighted into the target tube, measuring the temperature of the latter. Use of the radiation pyrometer and its accessories, such as the new silica block, is said to give a more constant calibration than is usually experienced with thermocouples, as well as lower net cost, and more open scaled divisions throughout the operating range.

AXIAL-FLOW FANS

Pressure and flow characteristics said to be superior to those of other equipment, at exceptionally high efficiencies, are claimed for a new line of axial-flow compressors, blowers and fans recently announced by the Buffalo Turbine Corp., 2165 Bailey Ave., Buffalo 11, N. Y. These units are of exceptionally small size for their high capacity, and required therefore the development of special motors of high horsepower and small diameter. As a result, the equipment is said to have an overall weight only 30 percent that of conventional equipment. A typical member of the line, illustrated in an accompanying view, is a 14-in. diameter blower which delivers 8,000 c.f.m. at 10 in. static pressure, turning at 3,450 r.p.m. The 20-hp. motor is only 8 in. in diameter and the complete unit weighs only 130 lb. It is claimed that the noise level is extremely low and that comparable pressures and flows are obtained at approximately one-half conventional design speeds.

The complete line will include direct driven units with air pressures ranging from 3 to 100 in. w.g., as well as direct-connected turbine-driven units for up to 100 lb. per sq.in. pressure and 100,000 c.f.m. capacity.

14-in., 8,000 c.f.m. axial-flow blower



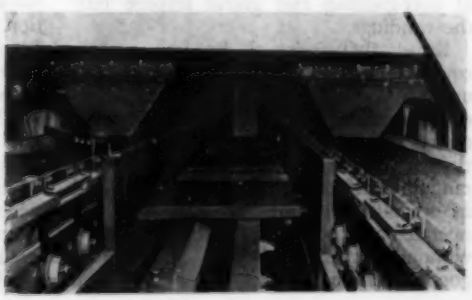
IONIZATION GAGE

Development of an improved ionization gage for measuring extreme low pressure in the range below 1 micron (0.001 mm. Hg) has been announced by Precision Scientific Co., 1750 North Springfield Ave., Chicago 47, Ill. The new gage, known as the Precision-Televac type E-31, is said to be the result of years of research aimed at eliminating the deficiencies usually associated with gages of this type. It is claimed that electrical leakage has been completely eliminated and that the gage, when used with a moderately high speed pumping system, is capable of outgassing itself. Automatic protection of the filament before and during operation is provided in such a way that current cannot enter the filament before the pressure has been lowered to 1 micron pressure, while the current is automatically turned off if the pressure rises above 1 micron.

These gages are interchangeable without recalibration and are guaranteed for 1,000 hours. Used with the Televac type S recorder, the gage comes on scale at 0.4 microns.

Type E-31 ionization gage

Closed loop bucket conveyor



BULK CONVEYOR

Handling of bulk materials in the horizontal plane is the function of a new self-feeding, self-discharging conveyor known as the Side-Kar Karrier, manufactured by Link-Belt Co., 300 West Pershing Road, Chicago 9, Ill. The conveyor employs a horizontal run-around path and requires minimum headroom, providing conveyor storage for materials that are to be discharged simultaneously in varying quantities at a number of points. Any surplus material still left in the conveyor buckets after they have served the several discharge points remains in the buckets to be recirculated. The conveyor may be fed automatically from any one of many feed spouts located above its horizontal run-around path, and it may simultaneously discharge automatically to a number of points. The material is carried in buckets supported on rollers, rather than being dragged by flights in a trough. On this account two or more materials can be fed separately to the conveyor with the assurance that the admixture will not be disturbed in transit.

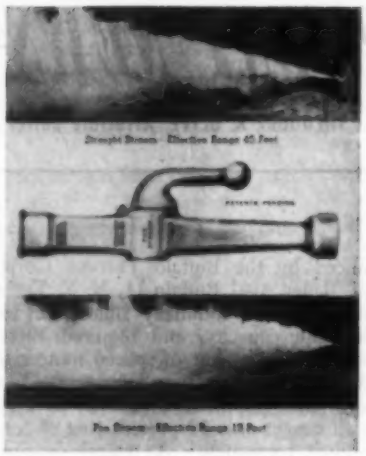
Two types are provided, one intended primarily for boiler-house application where the coal is kept in bunker storage and is delivered to one or more scale hoppers, while the second type, designed for other purposes, such as coal preparation plants, handles capacities up to 100 tons per hour and is particularly designed to avoid degradation and segregation. The handling of magnesium pellets without degradation is an example of application of the second type. Both types are claimed to require less horsepower, give longer life and less abrasion, and to permit no dust leakage. In general, both types consist of small hopper-bottom cars carried on wheels and operated in a continuous train, the track of which forms a closed loop. Driving is accomplished by a chain attached to the buckets inside the loop, traveling over large horizontal sprockets at the loop ends, which are driven from the driving motor.

GAS ANALYZER

To meet the war-accelerated demand for a special analyzer capable of testing high-purity gases such as oxygen, carbon dioxide, and nitrogen in the range from 90 to 100 percent, the Hays Corp., Michigan City, Ind., has developed the Series E analyzer which is quite similar to a standard Orsat, although the technique of operation differs somewhat. The new analyzer is offered in two styles, one a wall-mounted model for permanent installation, and the other a portable model in a metal carrying case. Both single- and two-unit types are available while a junior model, known as Series EJ, is obtainable with a burette capacity of 30 c.c. The smaller model, charged, weighs less than 6 lb.

EXTINGUISHER NOZZLE

To INCREASE the fire fighting effectiveness of its wheeled models, the Dugas Division of Ansul Chemical Co., Marinette, Wis., has introduced a new dual-stream nozzle for use on Dugas fire extinguishers of the dry chemical type. The new nozzle permits the operator to apply the chemical either with a long-range straight stream or with a shorter range fan stream. With the new nozzle overhead fires, heretofore considered exceeding difficult to fight, can be extinguished successfully. As a result of extensive tests with the new nozzle, greatly improved ratings have been given by Factory Mutual Laboratories to the Dugas wheeled extinguishers. The nozzle has also been approved by Underwriters' Laboratories.



New nozzle, with views showing straight and fan streams of chemical extinguishing agent

GAGE TESTER

CHEMICAL PLANTS having instrument shops where considerable testing of pressure gages is necessary will be interested in a new multi-purpose pressure gage tester developed by Mansfield & Green, Cleveland, Ohio. This device is claimed to offer for the first time in a single unit a pressure gage tester that can be used with equal facility for bench testing as well as for portable testing in the field. When used on the bench, the unit can be employed either with test gages or with a dead weight attachment. The device incorporates a simple, doubly sealed check valve which is said completely to eliminate leakage and loss of pressure, even with grit in the system, whether oil or water is being used as the pressure transmitting medium. Pressures up to 10,000 lb. per sq.in. can be handled.

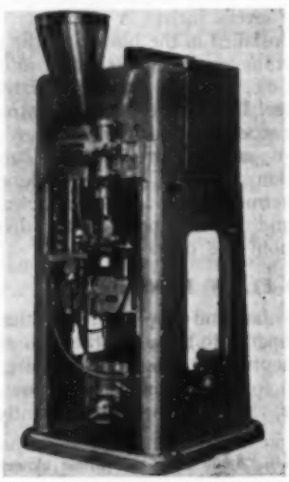
Gage tester for bench or portable work

WATER DE-IONIZER

SINCE the initial announcement of this company's de-ionization system of water treatment at the Chemical Show in 1943, considerable progress has been made by the Dorr Co., 570 Lexington Ave., New York, N. Y., in the development of such equipment for industrial use. An accompanying illustration portrays one of the new units. It is claimed that under commercial operating conditions, units of this character are able to deliver de-mineralized water, substantially the chemical equivalent of distilled water in purity, at costs ranging from 2 to 20 cents per 1,000 gal., the cost varying with the mineral content of the raw water. In comparison with costs of distilled water, commonly ranging from 65c. to $8 per 1,000 gal., the system is said to demonstrate savings in water costs of between 90 and 98 percent.

The system employed makes use of two stages. In the first stage, the raw water passes over a bed of exchange material which removes the calcium and magnesium constituents. Sodium and other metallic salts can also be removed at this stage, if desired. The exchange bed is regenerated with ordinary salt for the removal of calcium and magnesium. Where total removal is necessary, acid is used as the regenerant. In either case, a second step follows in which an anion exchanger absorbs the acid resulting from the initial step, producing water of final desired quality. The use of silica-free exchange materials of high mechanical and chemical stability is said to make possible long runs between regenerations.

Improved water de-ionization equipment



Improved automatic molding press

MOTOR BEARING

GREASING at intervals no more frequent than 5 years or longer is claimed by Westinghouse Electric Corp., East Pittsburgh, Pa., for motors which are now being equipped with a new prelubricated, sealed ball bearing. The new bearing consists of a standard single row of balls mounted in races of the same width as a double row ball bearing. Metal shields are anchored solidly in the outer race near the outer edges and extend down and inward to a close running clearance from the inner race. Adequate space for grease is thus provided and at the same time gives an effective seal against the leaking of grease or the entrance of dirt. This tightly sealed inclosure reduces oxidation of the grease, promoting longer grease life, keeps grease in and dirt out, and prevents the hazard of over-greasing and grease seepage into the windings.

Some thousands of lint-free motors equipped with these bearings have been used from 3 to 6 years in the textile industry, running 24 hours per day at higher room temperatures and higher humidity than are met in most applications. A recent random check of 600 such motors installed in six different mills, all of which had operated at least 4 years, 24 hours per day, without regreasing, showed all to be in good condition, without bearing wear and without grease deterioration. All were reinstalled with the recommendation that they be run three years more without relubrication.

AUTOMATIC MOLDING PRESS

AFTER more than seven years of experience with automatic molding presses, the F. J. Stokes Machine Co., Philadelphia 20, Pa., has announced the new Model 200-D completely automatic molding machine which incorporates a number of improvements. One of these is a new type trap or checking device, sensitive to a fraction of a gram, which weighs the finished molding and operates a safety cutoff to stop the machine in case all molded pieces do not eject into and pass through the trap. Should a piece stick in the mold, or should a molding be of insufficient weight, the machine will stop and signal for attention. Thus possible damage to the mold or machine from double filling or other failure in operation is practically eliminated. Another feature is an improved combination push-off that ejects mechanically in case the multiple air jets do not blow the molding into the trap. Still another is an improved triple-speed device which is readily adjusted to distribute exact quantities of molding powder where desired in the mold. The capacity of the machine is 15 tons, for all molded parts

with a projected area up to 14 sq.in. and diameters up to 4 in. A single-cavity mold is capable of producing 10,000 or more moldings in a 168-hr. week. The machine is self-contained, fully automatic, electrically heated and powered, and requires only 5 hp.

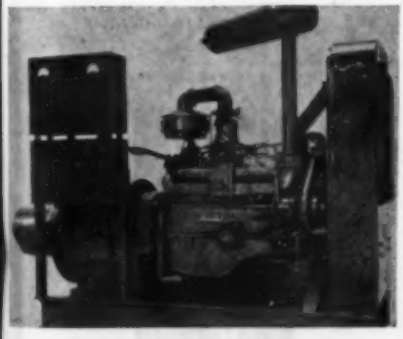
15 KW. GENERATOR

A PORTABLE generating unit of 15,000 watts capacity, which secures its power from a 6-cylinder water cooled gasoline engine, has been announced under the designation of Model 52MPK6 by the Cato Engineering Co., Mankato, Minn. The new unit produces 120/208-volt, 60-cycle, three-phase alternating current, and has overall dimensions of 70 in. x 49¼ in. x 24½ in. wide. The approximate weight is 1,860 lb. The unit can be furnished with a weatherproof housing, if desired.

ELECTRONIC MIST COLLECTOR

SEVERAL new features are incorporated in a new self-contained completely demountable electronic air filter known as the Electro-Mist, recently introduced by American Air Filter Co., 215 Central Ave., Louisville 8, Ky. This filter is intended primarily for collecting liquid mists and light concentrations of welding fumes. An axial flow fan mounted at the top draws air from the mist-producing operation, passing it first through a permanent filter unit to remove large drops and any metallic contamination. The air then enters an ionizer in which the entrained particles receive an electric charge before passing into the collector where they are precipitated on plates. The collected mist which accumulates drips from the lower edge of the plates through the filter into a reservoir below. All parts are readily accessible and removable without tools. Opening the access panel automatically shuts off current to the power pack and avoids possible hazard. Any residual static charge is automatically grounded. Collector plate assemblies are readily removed for washing or inspection. The unit is made in only one size, as shown, but as many as ten units may be operated in parallel, powered by one large power pack.

15-kw. generating plant



Electronic mist collector

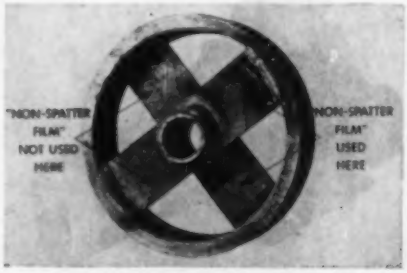
WELDING AID

A NEW liquid product, priced at only a few cents a quart and known as Lincoln Non-Spatter Film, has been introduced by the Lincoln Electric Co., Cleveland, Ohio, to minimize the adherence of welding spatter to metal and reduce the cleaning time. Extensive field tests are said to show that welding can proceed immediately after application, whether the film is wet or dry; the film can be sprayed or painted on the work; priming coats of paint may readily be applied over the film although the latter can be readily removed by washing; one application is effective for multi-pass welding; and spatter adherence can thus be prevented. The accompanying illustration shows the comparative appearance of adjacent areas after welding, one area coated with the film, and the other not so coated.

DIAPHRAGM MOTOR

MODEL V is the designation of a new diaphragm motor developed especially for use with throttling type pneumatic control instruments in the operation of rotary-stem valves and similar mechanisms. The motor is a product of Conoflow Corp., 2100 Arch St., Philadelphia 3, Pa. As appears from the accompanying illustration, it employs an outboard type of lever connection to the valve, thereby permitting the motor to be mounted directly over the valve body, rather than eccentrically. The device is unusually compact and has a low center of gravity. When it is used with a pneumatic valve positioner, it is said to be powerful enough to operate valves up to 8 in. in diameter. The operating lever can be clamped in any position of the lower 200 deg. of arc, and a second lever can, if desired, be attached to the other end of the outboard shaft.

Effect of using non-spatter film before welding



Diaphragm motor for rotary valve operation

MAGNETIC SEPARATORS

TWO NEW spout-type magnetic separators, one using an electromagnet and the other a permanent magnet, have been announced by Dings Magnetic Separator Co., 509 East Smith St., Milwaukee 7, Wis. In the electromagnetic type particles of iron are attracted to a step in the face of the double-gap high intensity magnet so as not to be knocked off by the flow of material. When material and current are shut off, the safety gate rises automatically to discharge any accumulation of iron. If current interruption occurs while material is still flowing, the safety gate automatically discharges the entire burden until the flow can be shut off and the current restored.

In the permanent magnet type an Alnico magnet is employed, available in both single- and double-gap designs. Again, the iron particles catch below a step in the magnet face. When the flow is stopped, the magnet opens on hinges for the removal of iron. The non-electric feature is desirable in some instances as it eliminates the need for wiring and the possibility of fire or explosion. Non-magnetic metal spout extensions are available for use where the magnet is to be mounted on metal chutes. Such magnets are made for spout widths from 6 to 24 in., or larger when needed.

EQUIPMENT BRIEFS

INDUSTRIAL cleaning time and cost are said to be reduced materially by an improved high-pressure cleaner unit for use with hot or cold water which is offered by A. B. Farquhar Co., York Pa. The unit, which is mounted on a truck for portability, includes a 5 or 7½-hp. motor, used respectively for the 10 gal. and 20 gal. per minute sizes, and a three-cylinder, single-acting reciprocating pump. Standard equipment includes 25 ft. of high-pressure hose, a gun and coupling. Jet pressures range from 300 to 500 lb.

THREE different kinds of welding can be accomplished, according to the manufacturer, with the new three-purpose welding electrode, No. 315, announced by Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y. The electrode is intended for producing horizontal fillet welds with flat or slightly concave profiles and concave fillets in the flat position, as well as satisfactory deep fillet and deep

groove welds. It is intended for such applications as the welding of pressure vessels and their connections.

AN IMPROVED hand-operated suction pump, built of inert plastic materials, and designed primarily for the emptying of 5 to 13 gal. acid carboys, has been announced by the manufacturer, The Alden Speare's Sons Co., Cambridge, Mass. The plastic is claimed to withstand constant immersion in practically all grades and kinds of commercial acids as well as alcohols, oils, soaps, water and many other materials.

MAGNETIC POWDER SEPARATOR

FOR SUCH applications as the removal of detrimental iron specks from powdered enamel frit, and similar purposes, the Stearns Magnetic Mfg. Co., Milwaukee 4, Wis., has announced the new KB magnetic separator. This separator is said to have a field of high magnetic concentration, particularly useful for batch operation and color control or for small capacity industrial problems. The machine employs an electrically operated vibrating feeder for distributing material in a uniformly even layer into the magnetic field. The design is such as to provide protection against contamination of the finished product at all times, should the electric current be interrupted for any reason. Unified electrical control, push button operated, with magnetic field and feed regulation, is provided to permit instant and simultaneous control of all details of operation. In use, pushing a button stops the feed, de-energizes the magnet, and moves the dividing vane to a position which permits the collected steel and iron particles to drop into the discard. Pushing the button again restores operation.

CLOSE-COUPLED PUMP

FOR SMALL capacities of water or other liquids at high pressures a close-coupled rotary pump manufactured by the Bump Pump Co., La Crosse, Wis., is available in capacities from ¼ to 8 g.p.m., for suctions to 26 in., and discharge pressures to 500 lb. on water, or 1,000 lb. on oil and other viscous liquids. The pump is a positive displacement type with a mechanical seal, the shaft being mounted on ball bearings. Built in by-pass and relief valves can be provided if desired. Any suitable metal can be provided.

Type KB magnetic separator

SLURRY PUMP

DESIGNED for the handling of liquids containing high percentages of solids in suspension, the new Type CW centrifugal slurry pump announced by Allis-Chalmers Mfg. Co., Milwaukee, Wis., is claimed to give efficiencies comparable with those of ordinary high-efficiency clear-water pumps. The pump is constructed of an abrasion-resistant alloy claimed to increase the life of the pump two to four times over pumps constructed of ordinary materials. Simplified design of the entire unit results in fewer parts than other comparable pumps and is said to result in minimum maintenance. Removal of the entire rotating element without disturbing the suction or discharge piping permits quick accessibility to the internal parts. In a recent installation one of these pumps was selected to handle 40 percent solids through a 400 ft. long discharge pipe, moving 800 to 1,000 tons of zinc tailings every 24 hours at a zinc reclamation project. It is this pump which is shown in the accompanying illustration.

HIGH VACUUM RECORDING GAGE

FOR THE continuous visible recording of pressure conditions within vacuum systems between the limits of 1 and 5,000 microns absolute pressure, a McLeod type gage has been developed by F. J. Stokes Machine Co., Philadelphia 20, Pa., which is capable of operating in conjunction with a recorder. The gage, which is a modified version of this company's usual high vacuum type, is mechanically tilted from the normal horizontal position to the vertical (reading) position by an electric motor. The height of the measuring capillary and hence the vacuum in the system is then electrically determined and this reading automatically transmitted to the recorder. The recording unit may be located at a distant point, but the instrument proper is preferably installed close to the sampling point. The Vacorder, as the combined instrument is known, thus consists of one recorder unit and as many as four indicating instruments which record in sequence on a strip chart. According to the manufacturer, this is the first time that it has been possible to accomplish automatic recording with gages of the true McLeod type.

Close-coupled pump

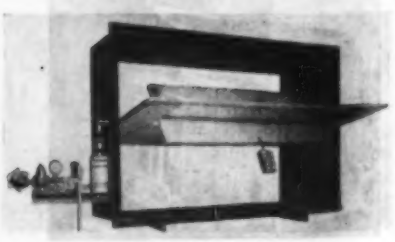
Type CW centrifugal slurry pump

STACK DAMPER

IMPROVEMENTS in boiler efficiency resulting in fuel cost savings ranging from 5 to 50 percent are claimed as a result of the use of the Stackmaster double-damper smoke control now being manufactured by Campbell Engineering Co., Appleton, Wis. Shown in an accompanying illustration, the damper is designed to adjust the smokestack to daily weather conditions in order to eliminate excess smoke, reduce stack temperatures and maintain uniform draft. The damper is available in a variety of sizes to accommodate various smokestack sizes, the specific design depending on the results of an engineering survey of the installation to which the damper is to be applied. Either electric, hydraulic or pneumatic control can be provided, depending on individual requirements.

McLeod type vacuum recorder

Double-damper smoke control



A Chem & Met PICTURED FLOWSHEET

1 Typical of the Colorado fluorspar flotation plants is this one of the Colorado Fluorspar Corp., Salida, Calif.

ACID-GRADE FLUORSPAR

FOR MANUFACTURE of hydrofluoric acid and fluorine chemicals, fluorspar must be high in calcium fluoride and low in silica. Yet very little fluorspar can meet the specifications for chemical grade material without special purification, usually by flotation. A general and composite fluorspar flotation process which incorporates the good features of many installations is here shown. This flowsheet is based principally upon data supplied by the Denver Equipment Co., Denver, Colo., flotation and ore beneficiation engineers.

Fluorspar is here fed through a two-stage crushing system, recommended for plants handling over 100 tons of ore daily, which permits crushing to about ½ in. This increases the capacity of the ball mill. Smaller plants usually use single-stage crushing to obtain a 1-1¼ in. product. The ball mill is in closed circuit with a cross-flow or spiral classifier; the grind varies from 35 to 200 mesh and is usually done at about 20-30 percent solids.

Since approximately half of the fluorspar ores contain sulphide minerals, usually those of lead and zinc, a sulphide flotation machine and filter are shown. A thickener is shown as an alternate ahead of the rougher flotation circuit since, in some cases, fine grinding results in over-dilution of classifier overflow, thus necessitating thickening prior to flotation. Soda ash is added to the flotation circuit to control the pH at about 8.5-10.0. Other reagents added usually include a frother, oleic acid (collector) and quebracho (calcite depressor). Conditioning ahead of rougher flotation varies from 5-15 min. at 20-30 percent solids. Standard "Sub-A" flotation machines are commonly used. The number of cleanings required to produce acid grade spar varies from 3 to 7, since the final concentrate must be 97.5 percent CaF_2 and under 1.0 percent SiO_2. Frothy flotation concentrates are usually handled by vertical centrifugal sand pumps.

Final flotation concentrate is usually pumped to a thickener from which the pulp (50-60 percent solids) is pumped to a rotary drum filter made with fine mesh, stainless steel filter media to prevent blinding of cloth due to fatty acid reagents. The filter cake, now having 6-8 percent moisture, is passed through a rotary dryer to bring the moisture content down to 1 percent or less. The dry fluorspar concentrate is then stored in steel tanks until ready for shipment to chemical plants. Recovery of fluorspar in concentrates should average about 80 percent for crude crystalline ore containing 51 percent CaF_2; higher grade ores give better yields.

CHEMICAL & METALLURGICAL ENGINEERING

August 1945

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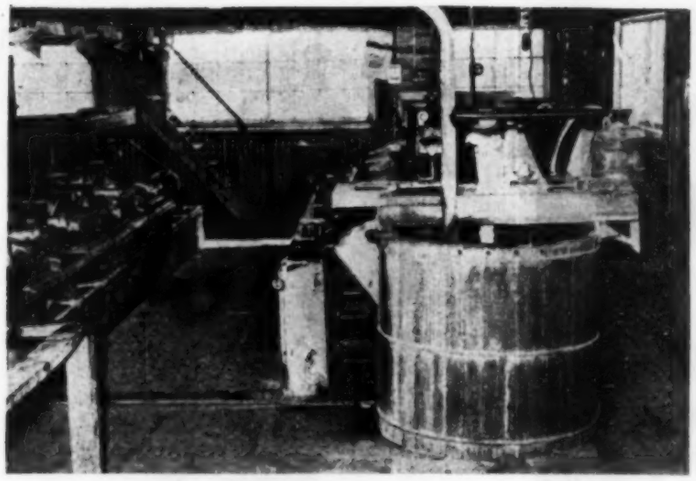
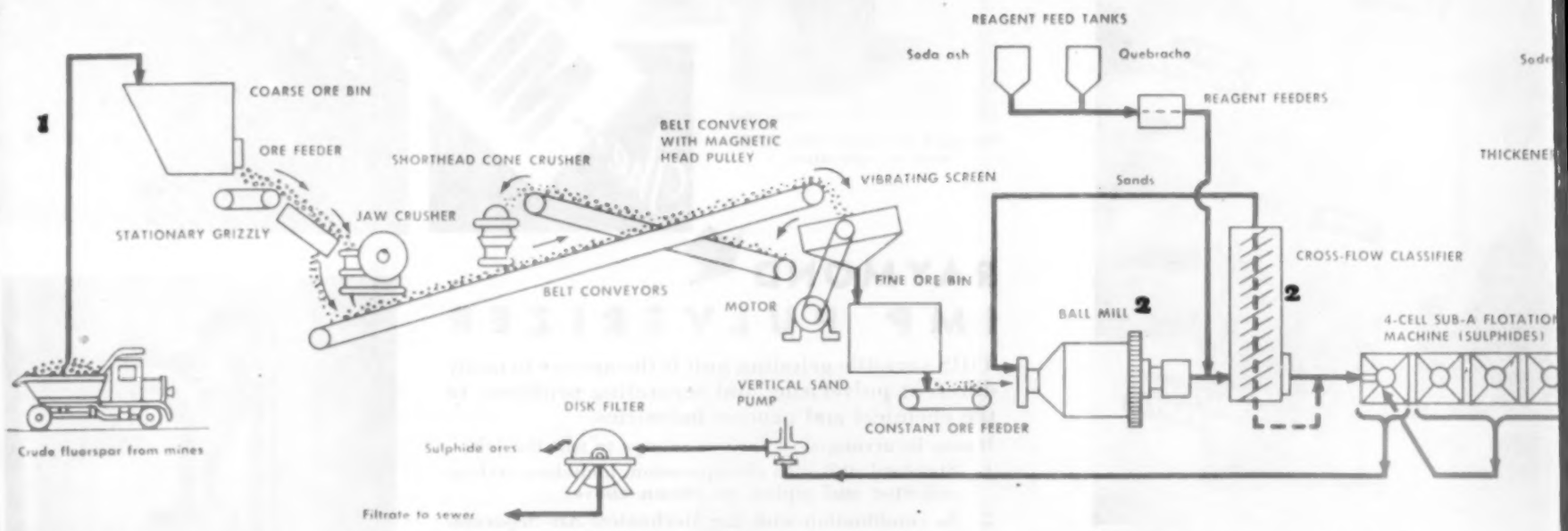
2 Ball mill in closed grinding circuit with a spiral classifier, in a Colorado fluorspar mill

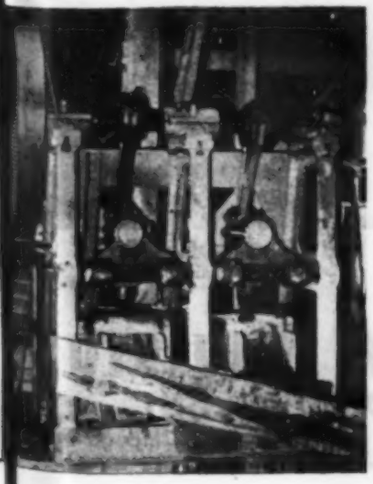


3 Flotation circuit showing conditioner ahead of rougher flotation. Usually oleic acid, sodium silicate and quebracho are added to conditioner

4 An eight-cell Denv cleaner. Operator is

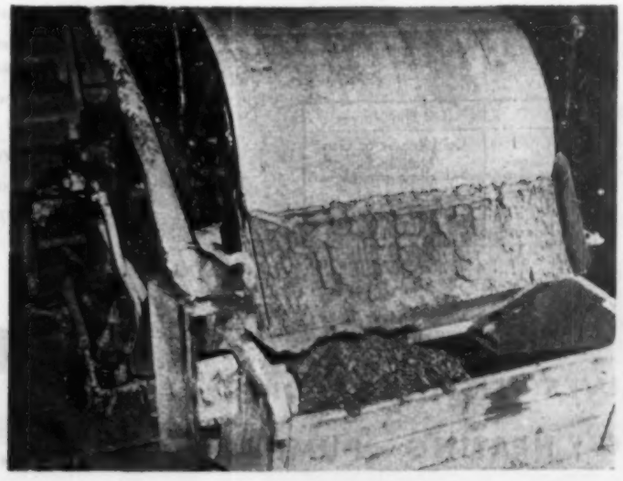


7 Settled flotation concentrates are pumped from thickener to filter



8 Diaphragm pump discharges thickened pulp to drum filter

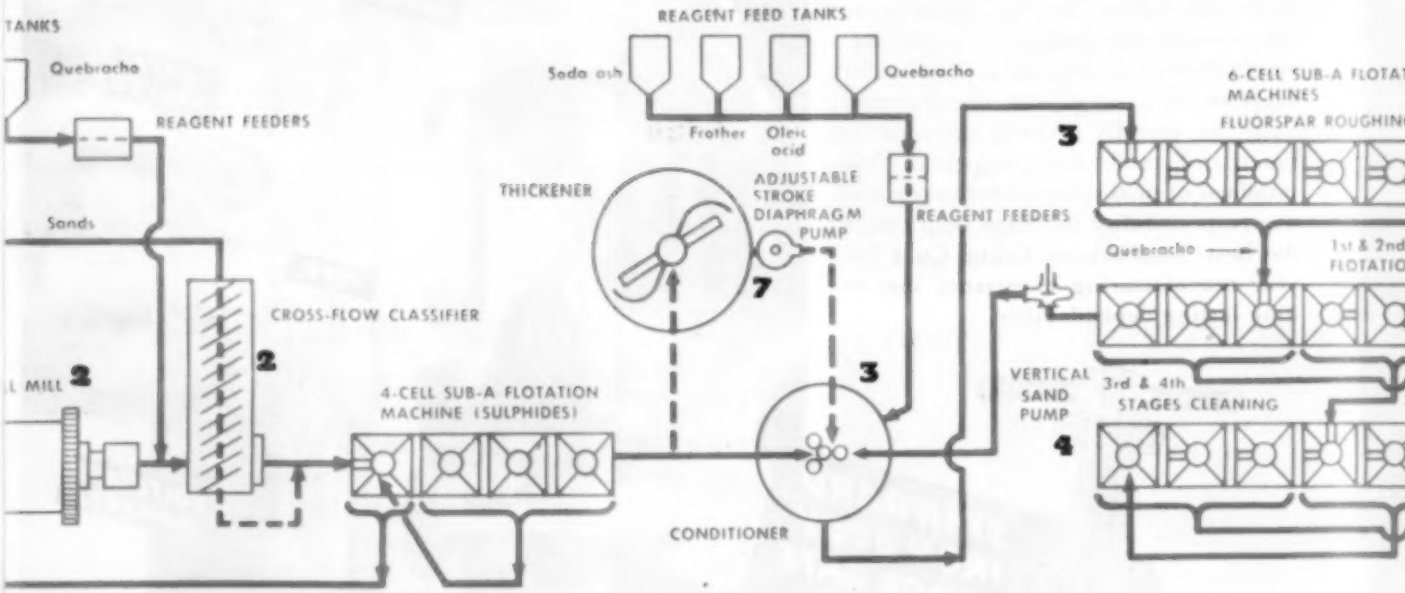
9 Rotary drum filter where water content is usually reduced to 6 to 8 percent. Filters are made of stainless steel



rougher flotation.
ided to conditioner

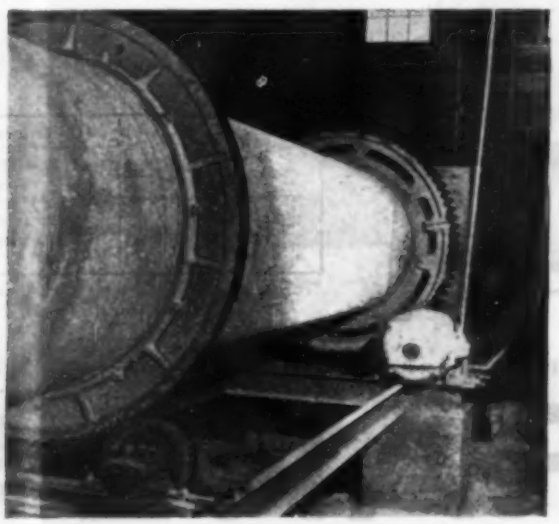
4 An eight-cell Denver "Sub-A" flotation machine being used as a cleaner. Operator is adjusting weir gate at one of the cells

5 Frothy flotatio
overcome by vertic

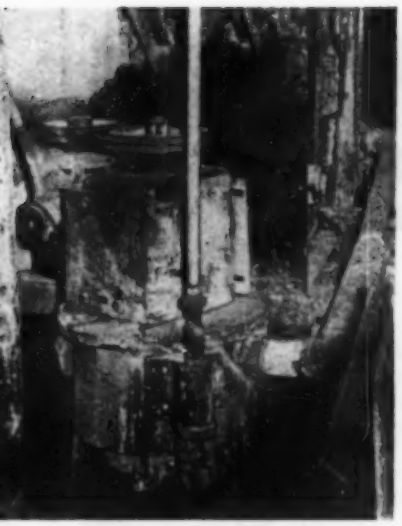


where water content is usually reduced
ers are made of stainless steel

10 Filter cake is conveyed to rotary, oil-fired direct-heat dryer which reduces moisture

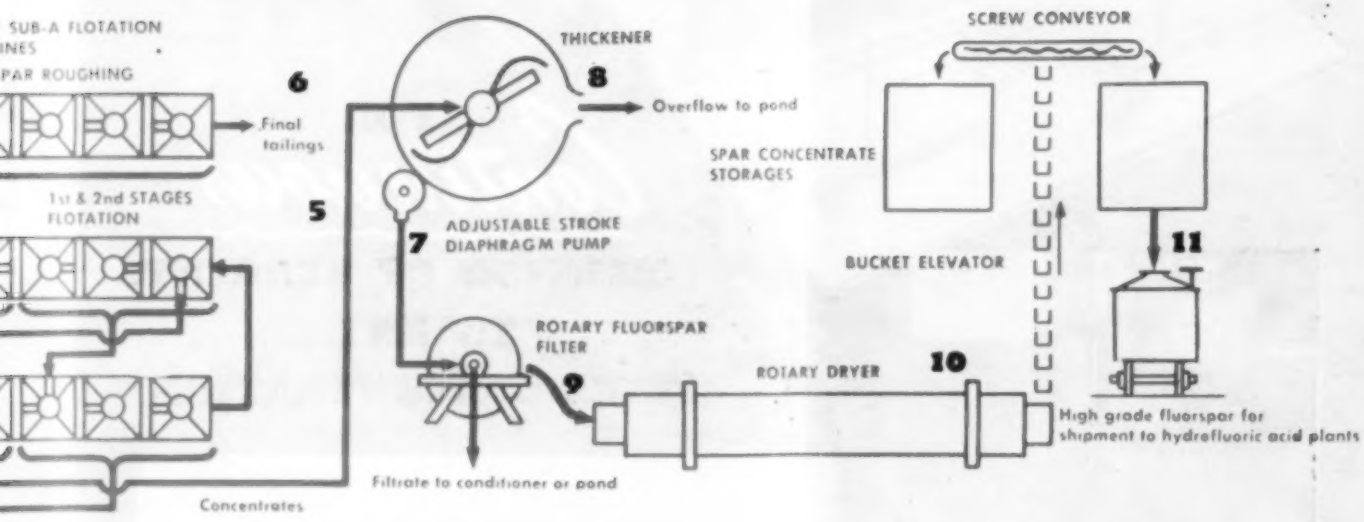


11 The f
Recovery o



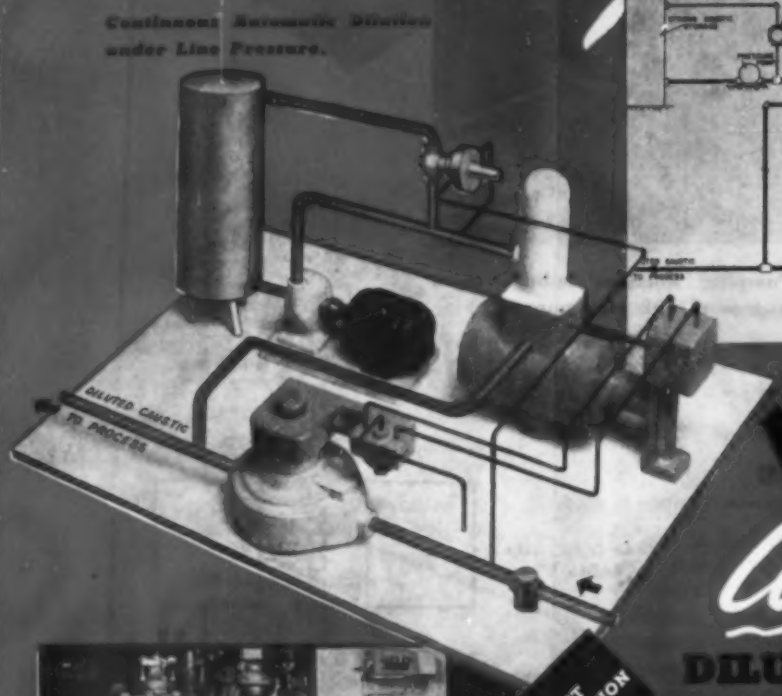
othy. flotation concentrates are usually me by vertical centrifigal sand pumps

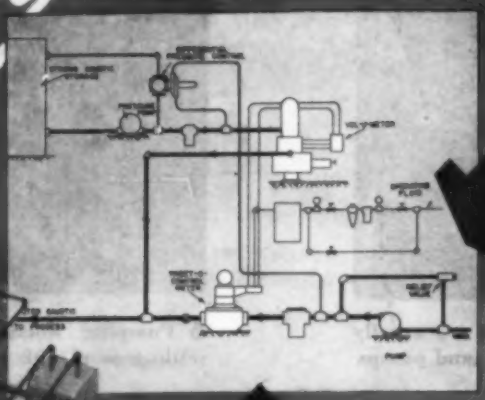
6 Pumping flotation tailings to a settling pond with sand pump



11 The fluorspar storage and elevator at anhydrous hydrofluoric acid plant of Tulsa Chemical Co., Tulsa, Okla. Recovery of fluorspar in concentrates should average about 80 percent for crude crystalline ore of 51 percent CaF_2

A Working PRINCIPLE



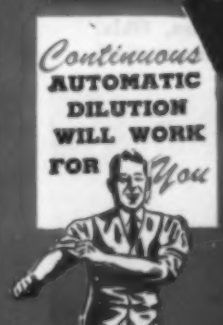


FLOW DIAGRAM

SCALE MODEL

PLANT INSTALLATION

FOR Continuous DILUTION OF REAGENTS TO ANY FINAL CONCENTRATION



For manufacturers who plan to beat postwar competition, the economy of operation and uniformity of end product resulting from "streamlined" production methods cannot be overlooked. The trend is already underway and many plants today are converting from batch tank measurements, relieving the operator from an excessive burden of responsibility. By using a tried and proven %Proportioneers% system, you eliminate guesswork, speed production, safeguard your investment in raw materials, maintain accurate control over end product.

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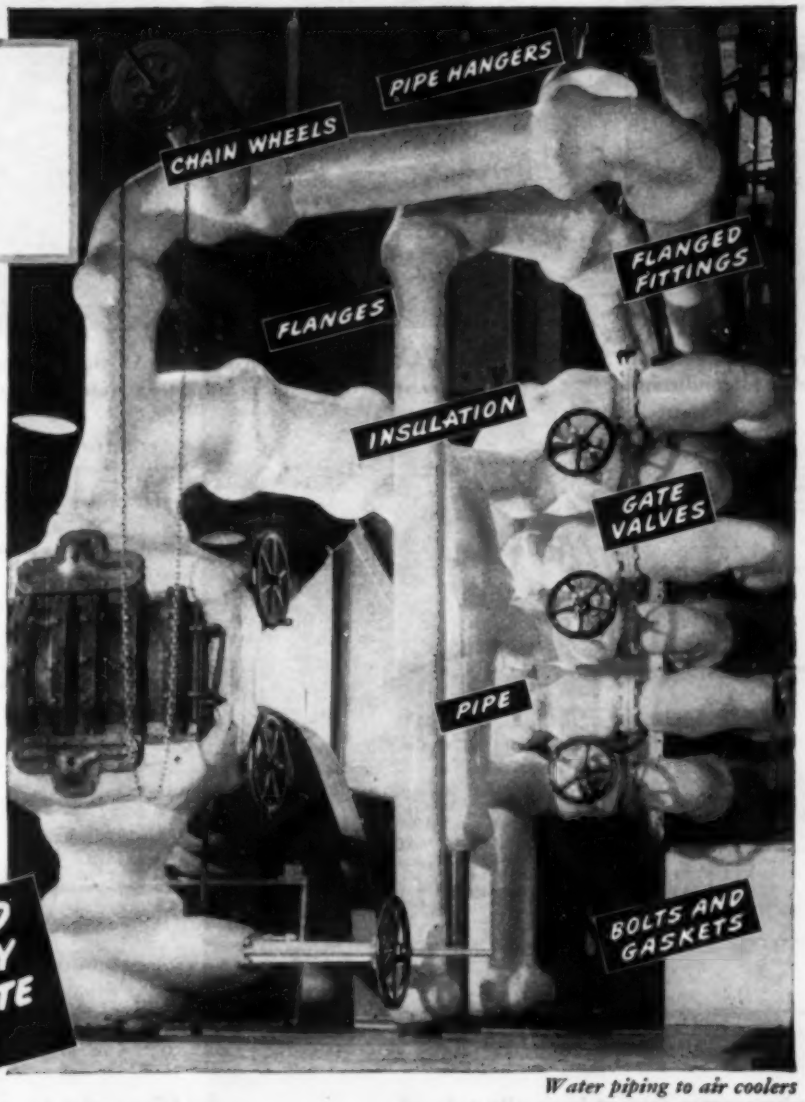
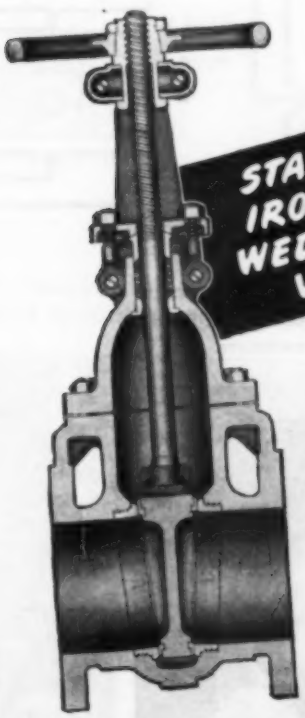
How the Complete CRANE Line Simplifies Piping Replacement Work

ONE SOURCE OF SUPPLY
ONE RESPONSIBILITY
ONE STANDARD OF QUALITY

The unusual completeness of the Crane line is of distinct advantage in "converting" piping systems. See the service recommendations below for Standard Iron Body Gate Valves. Here's a typical Crane solution to many deferred valve replacements. Your Crane Branch or Wholesaler supplies all your piping requirements from the world's greatest selection in brass, iron, and steel equipment. One standard of quality in all materials and one responsibility for them help insure the best installations. Crane Co.'s 90-year manufacturing experience insures long-lasting dependability.



Water piping to air coolers



SERVICE RECOMMENDATIONS: **Crane Standard Iron Body Wedge Gate Valves are suited for many services in factories and power plants, at all working pressures up to 125 pounds steam. Brass trimmed valves are recommended for steam, water or oil lines; all-iron valves for oil, gas or fluids that corrode brass but not iron. Made in O.S.&Y. and Non-Rising Stem patterns. See page 101 of your Crane Catalog.**

Working Pressures

Size of Valve	Screwed or Flanged End Valves		Hub End Valves
	Saturated Steam	Cold Water, Oil or Gas, Non-Shock	Cold Water or Gas Non-Shock
2 to 12 in.	125 pounds	200 pounds	200 pounds
14 and 16 in.	125 pounds	150 pounds	150 pounds
18 to 24 in.	*	150 pounds	150 pounds

*For steam lines larger than 16-in., Crane 150-Pound Cast Steel Gate Valves are recommended. (For sizes under 2-in., use Crane Clamp Gate Valves.)

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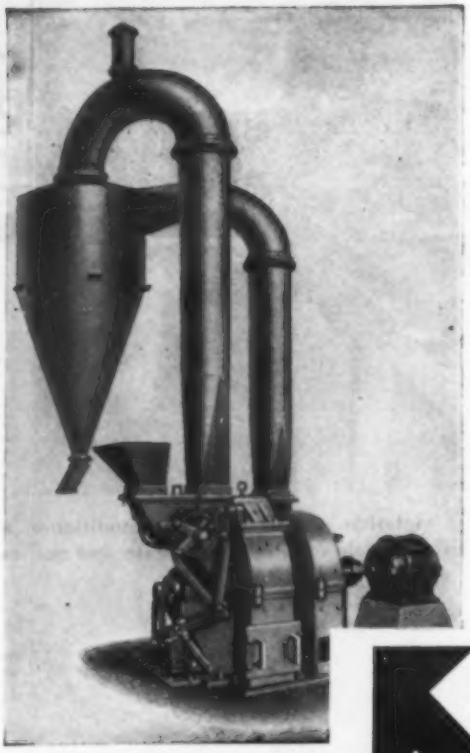
CRANE

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS



Standard Raymond IMP MILL with air separation

The ... MILL OF Multitude USES

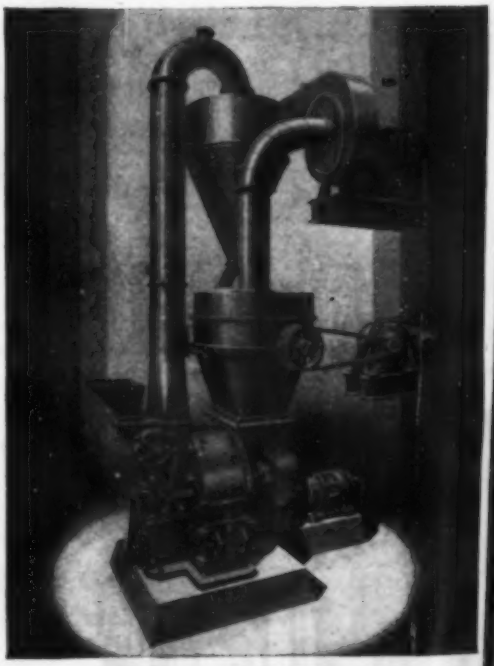
RAYMOND IMP PULVERIZER

THIS versatile grinding unit is the answer to many different pulverizing and separating problems in the chemical and process industries.

It may be arranged in various set-ups to suit the job:

1. **Standard unit with air separation, including cyclone collector and piping, as shown above.**
2. **In combination with the Mechanical Air Separator for closed circuit grinding operations.**
3. **Equipped with whizzer type separator to provide wide range fineness control and uniform classification, as shown at right.**
4. **With flash drying system for calcining operations, drying and grinding moisture laden materials.**
5. **For direct-firing small kilns and industrial furnaces . . . also pulverizing coal or pitch.**

If your production problem involves drying, pulverizing, separating, direct-firing, cooling or a combination of these . . . write for Catalog #55.



IMP MILL with Whizzer Type Air Separator

RAYMOND PULVERIZER DIVISION

COMBUSTION ENGINEERING COMPANY, INC.

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NEW PRODUCTS AND MATERIALS

JAMES A. LEE, Managing Editor

CONTENTS

NON-FLAMMABLE AVIATION FUEL

ACTUALLY the new aviation "gas" recently announced by Standard Oil Co. (New Jersey) is not non-flammable, but it does have a flash point above 100 deg. F. as compared to —40 deg. F. for ordinary 100 octane gasoline. It is thus about as safe to handle as kerosene, but it has as much power as 100 octane gasoline. Combining, as it does, low volatility and power, the new fuel might be regarded as what amounts to a 100 octane light fuel oil.

While it is obvious (see the accompanying photograph) that the fuel greatly reduces the hazard of accidental ignition, there is one very serious obstacle to its wide acceptance—it won't work in conventional airplane engines. The low volatility which makes it safe also makes it impossible to vaporize satisfactorily in any ordinary carburetor. That calls either for some kind of special carburetor which has not yet been forthcoming or for the use of new, redesigned engines equipped to inject fuel directly into the cylinder. Satisfactory fuel injection engines have been developed for aircraft, but the extent to which commercial airlines will adopt them to replace ordinary engines is questionable.

At any rate, according to Standard Oil, the fuel is ready for anyone who can use it, and after the war it can be supplied commercially and at a cost only slightly greater than that of today's 100 octane aviation gasoline.

LINSEED VARNISH OIL

A MODIFIED linseed oil, Kel-X-L, has been introduced by Spencer Kellogg and Sons, Buffalo, N. Y., as a substitute for currently scarce dehydrated caster oil, which itself had been developed early in the war to take the place of China wood oil.

Prominent characteristics of the oil are its fast bodying action in the varnish kettle, its compatibility with resins including less expensive resins like limed rosin, and its ability to produce fast-drying durable films with high water and alkali resistance. Its chemical constants are as follows: Acid no. 10-15, iodine no. 130-170, saponification no. 182-190, sp. gravity 0.962-0.966, viscosity Z-Z1.

ENGINE LUBRICANT

AN INTERNAL combustion engine lubricant containing no petroleum oils has been introduced by Carbide and Carbon Chemicals Corp., New York. This lubricant, now being produced in commercial quantities, has properties quite different in many respects from oils derived from petroleum.

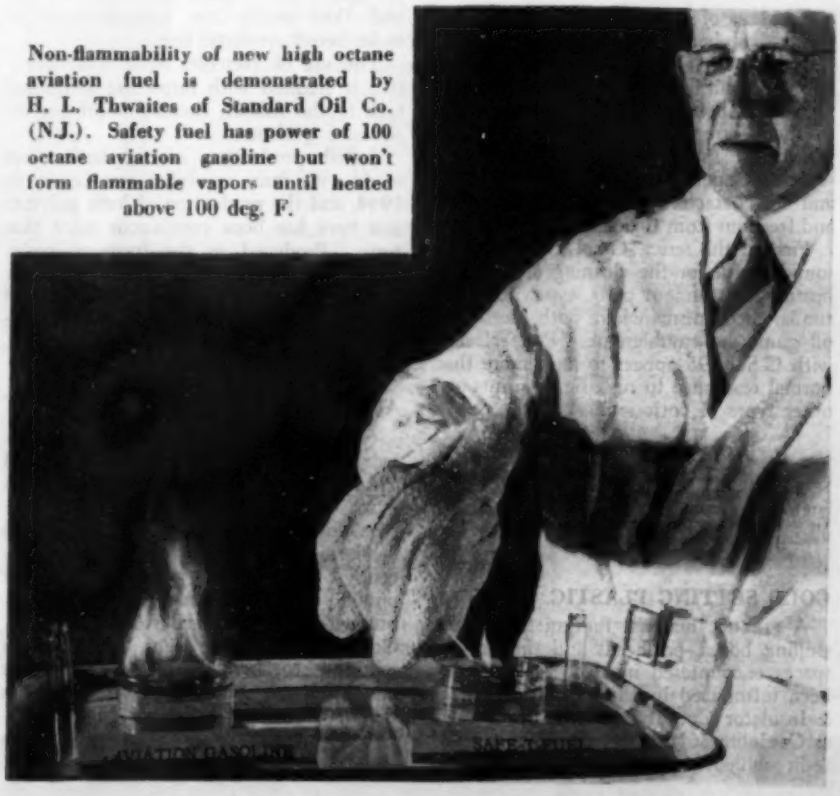
It can be manufactured to any desired viscosity and is characterized by low change in viscosity with change in temperature, having viscosity indexes in the range 140 to 160. Pour points vary from —30 to —80 deg. F., and flash points range upward from 300 deg. F. Densities approximate that of water. Carbon residue values are less than 0.01 percent regardless of viscosity, and the new materials are wax-free.

Ease of starting in cold weather and almost complete elimination of sludge and varnish formation are seen as the outstanding advantages. Wear of moving parts is about the same as with regular mineral oils. Large quantities are being used in military equipment and at the present time sales of the lubricants are restricted to war uses.

FLOOR CLEANSER

WITH the shortage of fats and oils, the problem of keeping their floors spic and span has become more difficult than ever for operators of department stores, office buildings, banks, schools, and other public buildings. To fill the gap, any number of soapless cleansers have been developed and the good ones are quite effective in their ability to emulsify dirt and hold it in suspension long enough to be rinsed away.

One such material is Maintenex, a product of the A. C. Horn Co., Long Island City, N. Y. But in addition to the customary qualities of any good cleanser (i.e., emulsifying power, freedom from fillers and abrasives, quick and complete solubility in water), this one offers still another feature which is said to be unique. When the pink crystalline powder is dropped into a bucket of water, it produces a fluorescent



Non-flammability of new high octane aviation fuel is demonstrated by H. L. Thwaites of Standard Oil Co. (N.J.). Safety fuel has power of 100 octane aviation gasoline but won't form flammable vapors until heated above 100 deg. F.

color in the solution. By observing the change in color, the user can tell just how much Maintenex to add to produce a solution strong enough for efficiency but not wastefully overdosed.

RESIN EMULSION ADHESIVES

A SOLVENT-FREE synthetic resin emulsion for adhering labels to "V"-board, wood, and black or galvanized iron, and which also serves as a waterproof label overcoating, has been developed by The National Adhesives Div. of National Starch Products Co., New York, N. Y. This product, in addition, has been found to adhere export labels firmly to synthetic rubber tires, a long-standing problem of that industry.

The adhesive is supplied in cold liquid form and can be diluted with water. When used as an overcoating, the emulsion "breaks" immediately, depositing a waterproof, transparent resin film on the surface. It neither clouds nor smears printing inks and is highly resistant to abrasion. The new adhesive can be applied by brush or gumming machine, is very fast setting and dries tack-free, even under high humidity conditions.

Identified as Resyn Adhesive Q3605, the product complies with current government specifications (such as AXS-1472) calling for the application of shipping and identification labels to various types of container with a water resistant adhesive and the application of a waterproof overcoating material. Heretofore, only lacquer-type adhesives were approved for this requirement. Now National's new adhesive can be used for the dual purpose. Its current price in drums is 22 c. per lb., f.o.b. Chicago or New York.

SAFETY SOLVENT

A SERIES of safety solvents to be called G-Sol has been announced by Gaybex Corp., Nutley, N. J. The various grades will be identified by numbers indicating their flash points, and it is reported that in their formulation, special emphasis is placed on safety, non-corrosiveness and solvency range. The G-Sols are water white and are characterized by high flash points and freedom from toxicity.

First of the series, G-Sol 195, has been found useful for the cleaning of precision bearings, instrument parts, typewriters and similar mechanisms where both grease and oil gums are troublesome. Parts cleaned with G-Sol 195 appear to have more than normal resistance to rust, finger prints and other types of corrosion.

Properties of G-Sol 195

Sp. gravity, 20 deg. C	0.801-0.803
Flash pt., open cup, deg. F	198
Fire pt., open cup, deg. F	200
Viscosity, centistokes, 100 deg. F	2.71
Residue on distil, max. %	0.1
Corrosiveness, standard doctor test	Negative

COLD SETTING PLASTIC

A FILLING material for junction boxes, stuffing boxes, pot-heads and similar void spaces encountered in electrical work has been introduced by the Irvington Varnish & Insulator Co., Irvington, N. J. Known as Cardolite 5616, this material is a liquid resin which, approximately four hours after mixing with an accelerator, will gel at room temperature to the point where flow is no longer possible. After several days the end product is a tough rubbery mass which will not flow under heat nor become brittle in the cold. The set compound is insoluble in water, oil, acids, and alkalis.

Although Cardolite 5616 will adhere to metal, it can be stripped away cleanly to allow repairs to terminals and cable strips. Originally made for filling junction boxes on marine cable installations, it is now offered for any application where a free flowing material is required which will set to form a rubbery solid.

LUBRICATING GREASE

EFFICIENT lubrication at widely different temperatures is the function provided for in a series of special greases now being produced in commercial quantities by Standard Oil of Indiana under the trade name, Stanogrease. The lubricant is used on instruments, aircraft control bearings, guns (in use or standby storage), and a variety of other close-fitting parts.

Properties which make the product especially advantageous are its high stability and low evaporation loss at high temperatures, low viscosity and low torque at low temperatures, good resistance to water and corrosion, and excellent lubricating properties. It is a lithium-soap grease, made from a selected petroleum oil and containing supplementary additives to give desired qualities.

RESIN EMULSIFIER

THE GOVERNMENT'S synthetic rubber program is taking sizable quantities of a special resin emulsifier newly developed by Hercules Powder Co., Wilmington, Del. Made from rosin, the emulsifier was placed on a production basis in an effort to help produce a better grade synthetic polymer and thus enable tire manufacturers to make better synthetic tires.

The use of Hercules rosin acid derivative is credited with imparting additional tack to the rubber, thereby improving its adhesive qualities.

Initial production of synthetic tires made with resin emulsifier was begun in 1944, and the production of both polymer and tires has been continuous since that time. Produced in the form of paste, the resin emulsifier is shipped by tank car to government polymer plants, pumped to storage tanks, and then piped to the reactors where the polymerization of butadiene and styrene takes place.

AIRBORNE LAMINATE

FOR SOME TIME the aircraft industry has been using experimental quantities of a laminate made by impregnating glass fabric or extra strong rayon with a new type thermosetting resin. The material has been kept more or less secret until recently, when it was announced to the public under the name of Conolon, product of the National Research & Mfg. Co. National City, Calif. Conolon is reported to be stronger than aircraft aluminum or magnesium alloys on a weight basis and has been highly satisfactory in replacing metals in certain structural uses.

Raw Conolon cloth, that is, sheets of fabric impregnated with uncured resin, is dry. Tack does not appear until a temperature of approximately 200 deg. F. is reached. In fabrication, sheets of raw cloth are piled on top of each other and bonded and cured under heat and pressure. Finished laminates may be produced either in flat sheets or in numerous simple shapes.

Curing requires a pressure of at least 10 psi. at a temperature somewhere between 275 and 500 deg. F. At 400 deg. F., the curing time is 10 min. When Fiberglas is used as the base fabric, the weight of Conolon is divided as approximately 80 percent glass and 20 percent plastic.

Physical Properties of Conolon Compared with Aluminum

	Conolon F-13 Parallel Laminated	Aluminum 24ST Alclad
Testing temp., deg. F	75	75
Sp. gravity	1.65	2.7
Young's modulus, tension, parallel to grain, psi	4.7×10^6	10.3×10^6
Ultimate column stress of sheets, parallel to grain, $L/r = 42$, psi.	53,000	45,500
Ultimate tensile stress, psi	120,000	69,000
Ultimate flexural stress, psi	100,000	102,000
Ultimate shear stress, psi.		
Right angles to grain	21,350	42,000
Parallel to grain	5,000	42,000
Hardness, Rockwell M	98-100	110
Rieble impact resistance, flatwise, ft. lb./sq. in.	120	62.5

Chemical Resistance of Conolon

Chemical Agent	Period of Immersion	% Gain in Wt.
Distilled water	24 hr.	0.35
Aromatic gasoline	24 hr.	0.8
Benzene	24 hr.	0.6
Acetone	24 hr.	1.5
Water, boiling	15 min.	3.0
	30 min.	3.0
Seawater	1 day	0.2
	2 days	0.66
	7 days	2.09
	30 days	4.65
Hydrochloric acid, 5% sol.	24 hr.	1.8
30% sol.	24 hr.	0.75
Sodium hydroxide, 1% sol.	24 hr.	1.0
10% sol.	24 hr.	22.0

SHARK CHASER

ONE OF THE strangest new products to be developed during the war is one designed solely for the purpose of giving offense to sharks. It seems that our sailors and flyers were growing jittery just thinking about the sharks that abound in tropical waters. While it is a statistical fact that only rarely do sharks attack a man, that is cold comfort to anyone who has had to take to his lifebelt. Consequently, the Navy had set out to discover a chemical which, when released in the water, would make the area so obnoxious to sharks that they would not come near.

When the project was first begun, at the Naval Research Laboratories, there were only two slender clues as to the sensibilities of a shark. Fishermen had observed that they scrupulously avoided waters where a dead shark was decomposing, and it was known that the squid and octopus repeatedly hide themselves from shark attack by clouding the water with a protective "ink." Discovering and synthesizing the repulsive chemical in decomposing shark meat was an odorous task, but the final result has no distasteful odor to human nostrils—only the shark

90 STANDARD REACTORS or STILLS to MEET YOUR *Specific Process Problem!*

PFAUDLER GLASS-LINED STEEL "E" SERIES KETTLES OFFER YOU WIDE SELECTION AT LESS COST

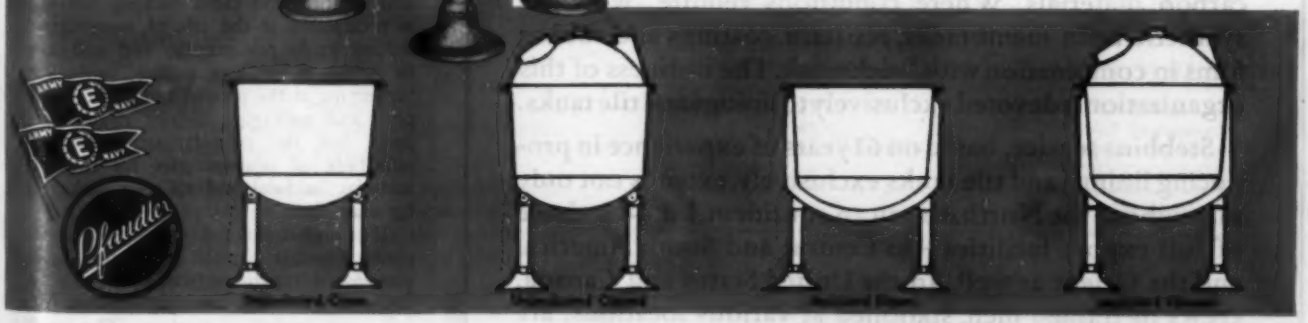
Sometimes there is a tendency to specify glass-lined steel reaction kettles of *special design* when a thorough study of Pfaudler's standard line of Reactors might do the job . . . *at a smaller initial cost.* While Pfaudler does build much equipment to customer specifications, it is surprising how many times standard kettles answer the purpose satisfactorily.

For example, the Pfaudler "E" Series Glass-Lined Steel Reactors for low pressure work, range in size from 5 to 2000 gallons. They are available in unjacketed open and closed design as well as steam jacketed, all with or without anchor or impeller agitators and motor drives. Closed designs may be equipped with top heads for reaction *or* distillation. Thus, there are 90 different models from which to choose in this series alone.

All "E" Series kettles are lined with Pfaudler glass, resistant to all acids (except HF) at elevated temperatures and at pressures within the limits permissible with clamped-top heads. Pressure varies with diameters and the maximum is sufficient for average conditions. (Where higher pressures are necessary, Standard "R" Series Reactors or custom-built equipment are available.)

Top-head openings have been laid out in conformity with the majority of requirements we have had since the "E" Series was first introduced in 1924. Openings which are not used can be sealed off either with glass-lined or Pyrex blanks.

Used separately or in conjunction with glass-lined condensers, receivers, pipe, fittings and valves, many complicated chemical processes are carried out economically in this standard equipment. If you do not have a copy of Bulletin 817, which covers the "E" Series, we shall be glad to send you one on request.



Pfaudler

Branch Offices: 330 West 42nd St., New York 18, N. Y.; 111 W. Washington Ave., Chicago 2, Ill.; 1325 Howard St., San Francisco 3, Calif.; 455 Paul Brown Bldg., St. Louis 1, Mo.; 7310 Woodward Ave., Detroit 2, Mich.; 1318 1st Nat'l Bank Bldg., Cincinnati 2, O.; 1228 Commercial Trs. Bldg., Philadelphia 2, Pa.; 751 Little Bldg., Boston 16, Mass.; Box 982, Chattanooga 1, Tenn.; Enamelled Metal Products Corp., Ltd., Artillery House, Artillery Row, London, S.W. 1, England.

THE PFAUDLER CO., ROCHESTER 4, NEW YORK

ENGINEERS AND FABRICATORS OF CORROSION RESISTANT PROCESS EQUIPMENT

Glass-Lined Steel . . . Stainless Steels . . . Nickel . . . Inconel . . . Monel Metal

objects. A synthetic ink, actually a new black dye called Calco Water Black SR, was devised by the American Cyanamid Co. In combination, the chemical and the dye make a man in the water both invisible and repugnant to any shark in the neighborhood.

As now produced, the two protective ingredients are mixed with a water soluble wax (to control solubility), formed into briquettes, inclosed in a cloth diffusion bag and sealed into a water-tight packet which can be attached to a life jacket. Thousands of these "shark chasers" have been provided as standard equipment in certain services. While the product is not world shaking nor loaded with postwar possibilities, it is nevertheless interesting as an illustration of the peculiar things that chemical engineers have been called upon to do—and done.

RUGGED UPHOLSTERY

AN EXTENSIVE new line of plastic upholstery for civilian use, which will provide designers and manufacturers with upholstery material that is both waterproof and flameproof, has been announced by U. S. Rubber Co., New York, N. Y. The plastic upholstery, known as Naugahyde, will be made in a wide range of bright, decorative colors, two-tone effects and a variety of grains.

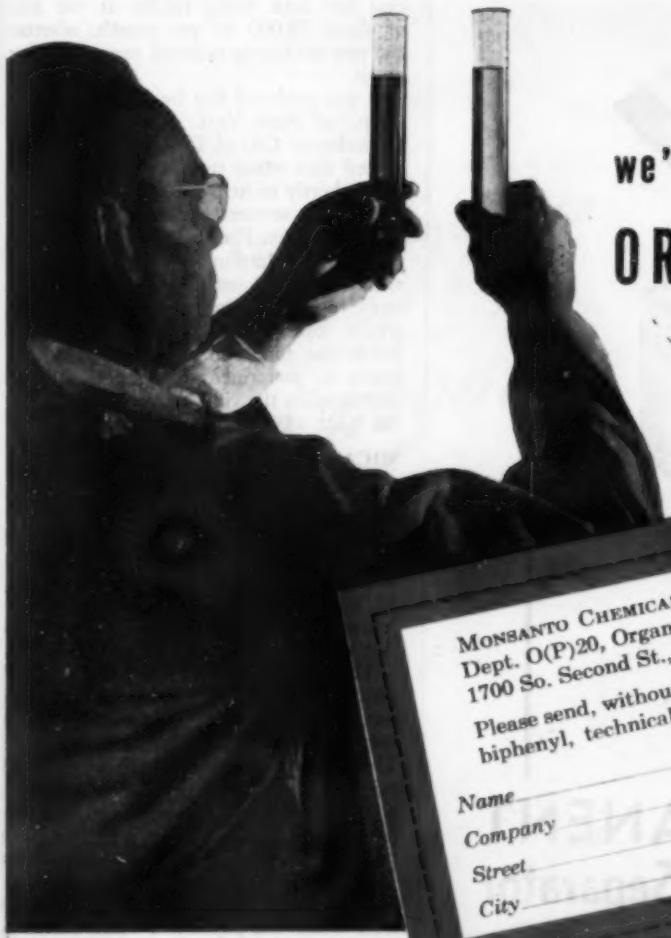
Because the material is waterproof and unharmed by the elements, it can be used successfully in lawn furniture, open cars, and boats. It will not be affected by perspiration, salt water, alcohol, gasoline, most acids and alkalis, and can be cleaned with soap and water. In addition it is pliable and easy to tailor; it will not get hard or crack and will resist edge-wear, abrasion, flexing and wrinkling.

Over a million yards have gone to war and after severe testing it has been adopted by the Navy as mandatory equipment for all Navy combat ships (see *Chem. & Met.*, April 1944, p. 143). It has also been used as seat covering in combat tanks, trucks, jeeps and aircraft. In the civilian market it will be offered for furniture, trucks, theater seats, railroads, automobiles, boats, and restaurants.

MOISTUREPROOF PACKAGING MATERIAL

SHEETS of aluminum foil with vinyl resin coating and cloth backing, are now in production at the rate of more than a million yards per month, and will soon be increased to three million yards. Its biggest use at the present time, is for wrapping and packaging aircraft engines and parts, but the manufacturers foresee a multitude of postwar uses for the new material, in food and tobacco packaging, for example.

The aluminum foil keeps out atmospheric moisture, while the vinyl coating provides a tough surface and, with the help of the cloth backing, prevents the foil from ripping or tearing. The resultant material is described by the Army as being excellent for packaging purposes—tough, strong, impervious to moisture. It is scheduled to replace a large part of the heretofore standard packaging material for aircraft engines and parts, a rubber-derived product of Goodyear Tire & Rubber Co., known as Pliofilm. Plio-



we'll be glad to send samples of ORTHO-NITROBIPHENYL

—the low-cost plasticizer, available without priority

MONSANTO CHEMICAL COMPANY
Dept. O(P)20, Organic Chemicals Division
1700 So. Second St., St. Louis 4, Missouri

Please send, without cost or obligation, samples of ortho-nitrobiphenyl, technical, as indicated: ☐ Grade A; ☐ Grade B.

Name _____

Company _____

Street _____

City _____ *Zone* _____ *State* _____

If you're having trouble finding the plasticizers you need, why not send for samples of Monsanto Ortho-Nitrobiphenyl? Try them in your laboratory and see if they are not the answer to your problem.

Monsanto Ortho-Nitrobiphenyl is available for immediate shipment in quantity . . . and without priority. The plasticizer is available in two technical grades. Technical Grade A should be used where color is important in the finished product. Carlot prices, f.o.b. St. Louis are: Technical Grade A, 10c a pound; Technical Grade B, 6c a pound.

You can use ortho-nitrobiphenyl as a plasticizer, alone or in conjunction with other plasticizers. It is applicable to the entire range of synthetic resins from the cellulose esters and ethers through the vinyls and vinyl copolymers. It is compatible with alkyds and some synthetic rubbers.

We shall be pleased to send complete data and samples for your experimentation. You may make your request on the convenient coupon, by contacting the nearest Monsanto office or by writing: MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 So. Second St., St. Louis 4, Mo.

District Offices: New York, Chicago, Boston, Detroit, Charlotte, Birmingham, Los Angeles, San Francisco, Seattle, Montreal, Toronto.

MONSANTO CHEMICALS
SERVING INDUSTRY...WHICH SERVES MANKIND

CHEMICAL AND PHYSICAL PROPERTIES OF MONSANTO ORTHO-NITROBIPHENYL

The figures included are approximately correct and can be considered as average values for ortho-nitrobiphenyl, technical.

	Grade A	*Grade B*
COLOR AND APPEARANCE	Light greenish yellow crystalline solid or oily liquid.	Light to dark reddish brown crystalline solid or oily liquid.
MELTING POINT		35°C.
BOILING POINT AT 760 MM.		320–330°C.
REFRACTIVE INDEX AT 25°C.		1.613
SPECIFIC GRAVITY AT 40°/15.5°C.		1.189
SPECIFIC GRAVITY TEMPERATURE COEFFICIENT		0.00083/°C. (33°–80°C.)
VISCOSITY AT 25°C. AT 45°C.		38 Centipoises 12 Centipoises
FLASH POINT		143°C. (289.5°F.)
FIRE POINT		179°C. (354.5°F.)

SOLUBILITY: Ortho-Nitrobiphenyl is readily soluble in most organic solvents but is practically insoluble in water, either hot or cold. Some of the materials in which Ortho-Nitrobiphenyl will dissolve are:

Benzene	Ethyl Acetate	Mineral Spirits
Ethyl Alcohol	Amyl Acetate	Pine Oil
Methyl Alcohol	Ortho-Dichloro-benzene	Turpentine
Ether	Carbon Tetrachloride	Linseed Oil
Acetone	Glacial Acetic Acid	Soyabean Oil
Methyl Ethyl Ketone		Corn Oil

film has been using rubber at the rate of about 70,000 lb. per month, whereas the new packaging material uses no rubber at all.

It was produced first by the Plastic Film Corp. of New York and later by the Dobeckmun Co. of Cleveland. It is expected that other suppliers will be called upon shortly to help meet requirements of the armed services. Plastic Film Corp. calls its version Plastin. Dobeckmun calls its product Metalam. Both products are essentially the same, but Plastic Film coats the aluminum foil with liquid resin, which forms a film, while Dobeckmun bonds the foil with pressure and an adhesive to preformed resin sheets. Goodyear supplies the vinyl resin sheeting under the trade name Vitafilm.

MICACEOUS PAINT PIGMENT

It would be difficult to name a pigment which has risen during the war to greater prominence than has zinc chromate. It has enjoyed a boom in popularity, particularly as a primer for coating metal surfaces. As a consequence this newly important prime coating has become extremely critical and available only for military uses.

This being the situation, formulators of metal primers should take interest in a recent announcement that a good substitute has been found for zinc chromate. This new reinforcing pigment is described mineralogically as a natural sericite type of graphitic muscovite (mica) containing approximately 0.5 percent graphite, with the graphite flakes actually embedded in the mica crystals and not merely mixed with them. So far as is known, the mineral from which the pigment is taken occurs in only one place in the country, a huge deposit at Hoke Station (near York), Pa., which is owned and now being worked commercially by the Chemical & Pigment Div., Glidden Co., Cleveland, Ohio. Only the simplest processing is required to refine the raw mineral and the resultant noncritical pigment can be supplied in large quantities and at about one-quarter the cost of the zinc chromate for which it may be substituted.

The product is marketed under the trade name Micalith G, and is said to possess all the characteristics of pure muscovite mica, plus certain unique characteristics attributable to the presence of graphite. For example, graphite within the mica crystals so modifies surface characteristics that a marked improvement in wetting and dispersion is noted as compared to other micaceous pigments. Also, it appears that the graphite acts as an oxygen acceptor to improve corrosion resistance.

To indicate its suitability for substitution, a number of test results may be cited. Repeated salt spray tests show that industrial primers containing zinc chromate, iron oxide, zinc oxide, and asbestine can be improved by replacing the zinc chromate with graphitic mica. Formulations with 15 percent of the new pigment replacing all of the zinc chromate and part of the asbestine have proved in standard tests to be at least equal to the unsubstituted primers. Preliminary tests show promise for a 25-50 percent replacement of aluminum flake in paints. Zinc dust-zinc oxide primers with 25 percent of the zinc dust replaced by graphitic mica show improved

adhesion and toughness after six months' outdoor exposure. When partially substituted on a volume basis for red lead, there is a considerable saving in weight and cost because of the difference in specific gravities, 2.9 for graphitic mica and 8.7 for red lead. Similar favorable reports have been made on the use Micalith G in automotive primers, traffic paints, heat-resistant blacks, emulsion paint, and in fire and water resistant coatings for duck and canvas.

Micalith G has already been incorporated into more than twenty-five of the Glidden Co.'s standard formulations and is now being used in sizable quantities by the Navy. It is also interesting to note that three western railroads have conducted exhaustive tests and now specify the material in their railroad prime coatings.

Properties of Micalith G

Composition	Same as muscovite ($KH_4Al_3Si_3O_{12}$), plus 0.5–1.0% graphite
Color	Slate grey
Sp. gravity	2.9
Refractive index, mean	1.58
Fineness	95% min. through 325 mesh. Particles are 1-50 microns dia., ¼–4 microns thick
Moisture content	0.25% approx.
pH, ASTM	5.0
Water-soluble salts, ASTM	0.03%
Oil absorption, ASTM	40, approx.
Bulking value	24.25 lb. per gal., approx.
Opacity	Low
Ignition loss, 800 deg. C. for 30 min	7.5%
Hardness	2–2.5 Mohs' scale (a very soft pigment)

COLD CREAM BASE

Of interest to cosmetic manufacturers is the recent announcement by the Heyden Chemical Co., New York 1, N. Y. of the development of a base for cold creams. Introduced under the name Pentamull 126-S, the compound is a derivative of pentaerythritol. It is supplied as a semi-solid, amber colored jelly. According to the manufacturers, it is possible to use the product in recognized cold cream foundations. It is also possible to make absorption base cold creams using Pentamull 126-S to replace the now scarce lanolin.

FLUORESCENT FLAW DETECTOR

In the April issue of *Chem. & Met.*, p. 138, there was described a fluorescent dye developed by the Switzer Brothers, of Cleveland, which is used to color signal panels employed by our ground forces in communicating with their supporting aircraft.

Other developments in the use of fluorescence are the Zyglo and Magnaglo processes, marketed by Magnaflux Corp., Chicago, under Switzer patents. These are two methods used in non-destructive testing of manufactured articles for inherent defects. Zyglo is a fluorescent penetrant into which aluminum, magnesium, stainless steel, plastic, glass, or ceramic pieces are dipped for testing. An oil base carries the fluorescent material into cracks or other open defects. Examined under black light, after surface washing, cracks so small as to be normally invisible will be marked by a bright fluorescent line. The Magnaglo inspection method involves magnetizing the part, and flowing over it the para-magnetic particles in a thin oil suspension. Any discontinuity at or near the surface results in local magnetic poles which hold particles at the defect. The pattern of fluorescent particles under black light describes the defect.

CHEMICAL ENGINEERING NEWS

AMERICAN TECHNICAL MEN INVESTIGATE GERMANY'S INDUSTRIAL WAR DEVELOPMENTS

MORE THAN 200 American scientists engineers and other technical men are now in Europe investigating Germany's technical industrial war secrets under the direction of the Joint Chiefs of Staff and in conjunction with the Foreign Economic Administration. Important information already has been obtained and some investigators have completed their work and returned. However, the greater number still are overseas and others are going over.

At the direction of the military, and in association with other government agencies, FEA early this year began adding the experts to its staff for dispatch into Germany as soon as the military situation permitted. Many were in Germany before V-E Day, gathering technical industrial information before the enemy could destroy documents or equipment. The information gathered by the experts becomes government property but arrangements are in effect to make available at once to war industry such intelligence as may be useful against Japan. Procedures also are being established for a wider dissemination of the information as soon as practicable.

Among the new developments uncovered so far are: New uses of waste cellulose materials for the manufacture of fats for human and cattle food; improved techniques for producing synthetic petroleum products; hydrogenation plants operating at extremely high pressures; new catalysts permitting the Germans to convert oil to high-octane gasoline more quickly than was known here; details on German refinements in the gas synthesis method of producing liquid fuels and lubricants from coal; new processing methods in the field of synthetic rubber; new data on acetylene and electrochemical processes; information on high-temperature alloys unknown in the United States; production of high-grade nitrocellulose from lower grade wood pulp with stability superior to the same product made from high grade pulp in the United States.

The civilian technical personnel who have returned or are still abroad are as follows, all having been dispatched by the Foreign Economic Administration except where otherwise noted:

Chemicals—Stephen L. Tyler, executive secretary, American Institute of Chemical Engineers; Zola G. Deutsch, consulting engineer, Deutsch & Loonam; Ray H. Boundy, assistant to the president, Dow Chemical Co.; Lowell B. Kilgore, founder and director of research, Kilgore Development Corp.; Verne C. Bidlack, specialist, McCloskey Varnish Co.; Walter J. Murphy, editor, *Industrial and Engineering Chemistry*, American Chemical Society; Thomas S. Nichols, vice president and general manager, Payson Paint & Varnish Co.; Joseph Neubauer, plant superintendent, Pittsburgh Plate Glass Co.; R. Leonard Hasche, director of research and development, Tennessee Eastman Corp.; Harry A. Curtis, dean, College of Engineering, University of Missouri; and Sidney D. Kirkpatrick, editor, *Chemical & Metallurgical Engineering* McGraw-Hill Publishing Co., who was sent by the War Production Board.

Liquid Fuels and Lubricants—Sent by Department of Interior, Bureau of Mines: Lester L. Hirst, chemist, Louis L. Newman, gas engineer, William W. O'Dell, chemical engineer, Wilburn C. Schroeder, acting chief, Office of Synthetic Liquid Fuels, and Guenther Von Elbe, chemist-all from the Bureau of Mines, and Alfred R. Powell, assistant director of research, The Koppers Co. Sent by the Petroleum Administration for War: Ernest Cotton, chemical engineer, and Paul K. Kuhne, assistant to general manager, Gulf Oil Corp.; William A. Horne, assistant head of petroleum process section, Gulf Research and Development Co.; Warren F. Faragher, Houdry Processing Co.; George S. Bays and Ernst F. Voss, chief engineer, Humble Oil & Refining Co.; Irving H. Jones, chemist, The Koppers Co.; Horace M. Weir, chemical engineer, M. W. Kellogg Co.; Donald S. Fraser, chief, technical section, foreign refining division, Petroleum Administration for War; John G. Allen, process engineer, and Jean P. Jones, chemist and attorney, Phillips Petroleum Co.; Byron L. Mackusick, gas engineer, and Hans Schindler, Sr., research chemist, The Pure Oil Co.; L. P. Evans, chemical engineer, Socony Vacuum Oil Co.; Leonard E. Carlsmith, chemical engineer, Standard Oil Co. of Louisiana; E. L. Baldeschweiler, chemist, Standard Oil Development Co.; Harold V. Atwell, research supervisor, The Texas Co.; Vladimar Haensel, research chemist, Universal Oil Products Co.

Medical—James H. Williams, American Cyanamid Co.; Victor Conquest, director of research, Armour & Co.; Everett L. Hoskins, president, Cooke-Waite Laboratories, Inc.; Adam H. Fiske, executive director research and control, Erwin C. Kleiderer, pharmaceutical chemist, and John A. Leighty, research chemist, Eli Lilly & Co.; Kenneth Blanchard, special investigator, Johns Hopkins University; Russell J. Fosbinder, president, Maltbie Chemical Co.; Arthur E. Meyer, director of research, The Maltine Co.; Charles B. Jones, associate professor of metallurgy, Pratt Institute; Robert A. Kehoe, head, department of applied physiology, College of Medicine, University of Cincinnati; Justis B. Rice, director of medical research, Winthrop Chemical Co.

Rubber—Rudolph A. Schatzel, director of research, General Cable Corp.; Benjamin S. Garvey, resident chemist, B. F. Goodrich Co.; Robert D. Juve, research chemist, Goodyear Tire & Rubber Co.; Arthur H. Nellen, chief chemist, Lee Tire & Rubber Co.; James E. Troyan, specialist synthetic rubber, Phillips Petroleum Co.; William L. White, director of research, Raybestos-Manhattan, Inc.; John W. Livingston, vice president, Rubber Reserve Co. Dispatched by War Production Board were: Carl C. Monrad, professor of chemical engineering, Carnegie Institute of Technology; Jean Fennebresque, vice president in charge of research development, Celanese Chemical Co.; Ernest T. Handley, chemical engineer, Firestone Tire & Rubber Co.; Russell Hopkinson, director of commercial development, U. S. Rubber Co.

Solid Fuels—Harold J. Rose, field technologist chemical engineer, Bituminous Coal Research, Inc.; John W. Buch, mining engineer, Lawrence D. Schmidt, senior chemist, and Harry F. Yancey, supervising engineer, Northwest Experiment Station, Bureau of Mines; Homer H. Lowry, director coal research laboratory, Carnegie Institute of Technology; Frank Reed, chief chemist, State of Illinois, Geological Survey Division.

Textiles—J. J. Schilthuis, chief chemist, American Enka Corp.; LeRoy Smith, manager and Daniel Wicker, pilot plant superintendent, American Viscose Corp.; Preston Hoff, director of nylon research and V. B. Quig, E. I. du Pont de Nemours & Co.; Elliot D. Grover, professor and head of yarn manufacturing, North Carolina State College; Edgar C. Guenther, engineer of acetate division, Tennessee Eastman Corp.

Among the technical investigatiors attached to the Armed Service Forces, by far the most important chemical group was that headed up in London by Lt. Col. Philip R. Tarr working under the direction of Gen. Hugh Rowan in Paris. The following well known American chemists, chemical engineers, and executives were active investigators of German targets: Gaston Du Bois and Francis J. Curtis of Monsanto; William S. Calcott, Lester M. White and J. W. Haught of DuPont; Ernest H. Volwiler of Abbott Laboratories; M. F. Fogler and Karl Nilsson of Solvay; John M. Harris of Barrett; P. J. Leaper of General Chemical; R. Lindley Murray of Hooker Electrochemical; Jean Kern of National Aniline; Roy W. Sudhoff of Monsanto; W. Hirschkind, of Dow; Hans Neumark of General Chemical; and L. C. Turnock, consultant of Cleveland.

Ordnance technical personnel included Carl D. Pratt of Atlas Powder; John M. De Bell, consultant; and Gordon Kline of the Bureau of Standards. J. A. Ross of the Canadian Ministry of Supply and Munitions headed another group of technical specialists. Navy Tech., under Com-

modore Schade, has many investigators in Germany, most of them being commissioned officers rather than civilians temporarily attached to the Services.

LENGTHY REPORT ON EAST OHIO GAS CO. FIRE

COMPLETING their study of the East Ohio Gas Co. liquefied natural gas fire which created so much havoc in Cleveland on Oct. 20, 1944, the technical consultants of the Mayor's Board of Inquiry rendered their report to Mayor Burke on July 20, 1945. These consultants, including Profs. G. E. Barnes, M. M. Braidech and K. H. Donaldson, reported in great detail on the design of equipment involved in the liquefied gas storage plant; on the evidence from witnesses and from the remains of the two destroyed tanks and associated equipment; and on their conclusions and recommendations. Unfortunately, it proved impossible to state definitely what the cause of failure was. Nevertheless, sufficient information was disclosed to account for a number of possibilities which, separately or in combination, might have led to the disaster. In particular, they found evidence of good faith and diligence on the part of all persons and organizations that participated in the development and execution of the project.

Among the conclusions were these: No single element in the situation, taken alone, could account for the disaster; the location of the plant, considering the hazard, was poorly chosen; the distances between storage tanks were insufficient and certain other precautions usual in handling hazardous materials were given less attention than the circumstances seemed to warrant; the selection of a cylindrical tank for the No. 4 vessel, in contrast to the spherical tanks used for the first three vessels, was unfortunate considering the brittleness of the 3½ percent nickel steel used at the low temperature of operation. (This particular alloy, used for the inner shells, was not proven to be suitable; in fact, tests by the U. S. Bureau of Mines on a fragment from No. 4 tank, showed a much lower impact value at the temperature of operation than had been specified as necessary by the tank designer.) Initial failure probably took place at the top of the inner shell of cylindrical tank No. 4, although calculated stresses were within normally accepted limits; primary stress calculations indicated that these had been kept low, although some of the secondary stresses may have been unduly high; the fragmentation of tank No. 4 indicates either shock on a very brittle material, or failure resulting from a violent internal explosion; possible sources of shock included a manually operated valve which could be closed so as to strike a blow of considerable force, and "bumping" of the liquid due to rapid ebullition; ground tremors from railroads and industrial operations, possibly a contributing cause, cannot be assigned primary blame.

In making recommendations for possible future installations, the consultants felt that neither the public authorities nor the industry had given sufficient attention to potential hazards and that for future

safety in similar circumstances, matters of policy and procedure should take precedence even over technical matters. Although, they stated, it must never be the policy of the public authorities to badger industry by needless restrictions, still the burden of proof must be on industry, and must be established by measures that are intelligently exacting, rather than merely routine.

KANSAS CITY TECHNICAL MEN ORGANIZE COUNCIL

SEVENTEEN professional and technical societies of the Kansas City area have joined forces in establishing the Technical Societies Council for unified action in matters pertaining to the development of scientific endeavors.

A monthly bulletin will be published programming activities of all organizations. Some of the principal objectives to be advanced immediately include support for establishing better technical and scientific libraries in this region; encourage the establishment of educational courses of a technical and scientific nature in the schools of this area and co-ordinate the vocational guidance activities of the constituent organizations; to co-operate with civic, educational and government agencies in matters requiring professional assistance.

At the organization dinner-meeting held in Kansas City July 9, Dr. W. M. Hoehn, laboratory director of the George A. Breon & Co., was elected chairman; C. M. Lytle, Missouri Society of Professional Engineers, with the Kansas City Power & Light Co., vice chairman; and Charles Briggs, member of the American Society of Mechanical Engineers, with the Burns & McDonnell Engineering Co., secretary-treasurer.

Headquarters of the newly formed Council will be in the offices of the Midwest Research Institute, Kansas City. Miss Sarah C. Lechtman, a member of the Institute's staff will be manager of publications.

NEW ALLYL CHEMICALS UNIT IN OPERATION

Now beginning full-scale operations at the Houston, Texas, refinery of Shell Oil Co. is the first commercial allyl chloride plant in this country and the second commercial allyl alcohol unit. This group of petroleum-derived organic chemicals promises to become important raw materials in the new field of allyl resins and plastics. Allyl chloride is expected to be the starting point of a broad field of plastics based upon carbohydrates such as starch, cellulose and sugar. It is already important as a raw material in the drug and pharmaceutical fields. A byproduct of the allyl alcohol process is a mixture of 1, 3-dichloropropylene and 1, 2-dichloropropane that shows promise as a soil fumigant.

RESEARCH PROJECT AIMED TO EXPAND USE OF PEANUTS

THE National Peanut Council with headquarters in Atlanta, Ga., has established a project in Southern Research, Institute, Birmingham, Ala., for research on peanuts and peanut products. With the South's peanut crop breaking all previous production records, need is felt for expanding the base for peanut products in

the food and chemical industries. The program at Southern Research Institute, which will be under the direction of C. Lewis Wrenshall, will involve a comprehensive survey of all past and current research efforts on peanuts and will aim to uncover new fields offering the greatest promise for further study.

STANDARD OF INDIANA FORMS CHEMICAL DEPARTMENT

ORGANIZATION of a chemical products department by the Standard Oil Co. of Indiana is in progress according to an announcement by A. W. Peake, president of the company. He said the immediate duties of the department will be to explore the market for petroleum chemicals, work with research and manufacturing departments in developing and producing marketable derivatives, and manage sales and distribution.

The new department will operate under the general direction of Bruce K. Brown, vice-president in charge of development, with William B. Plummer as manager. Howard R. Peterson of the sales technical service staff will be in charge of sales development. Other staff members are being selected.

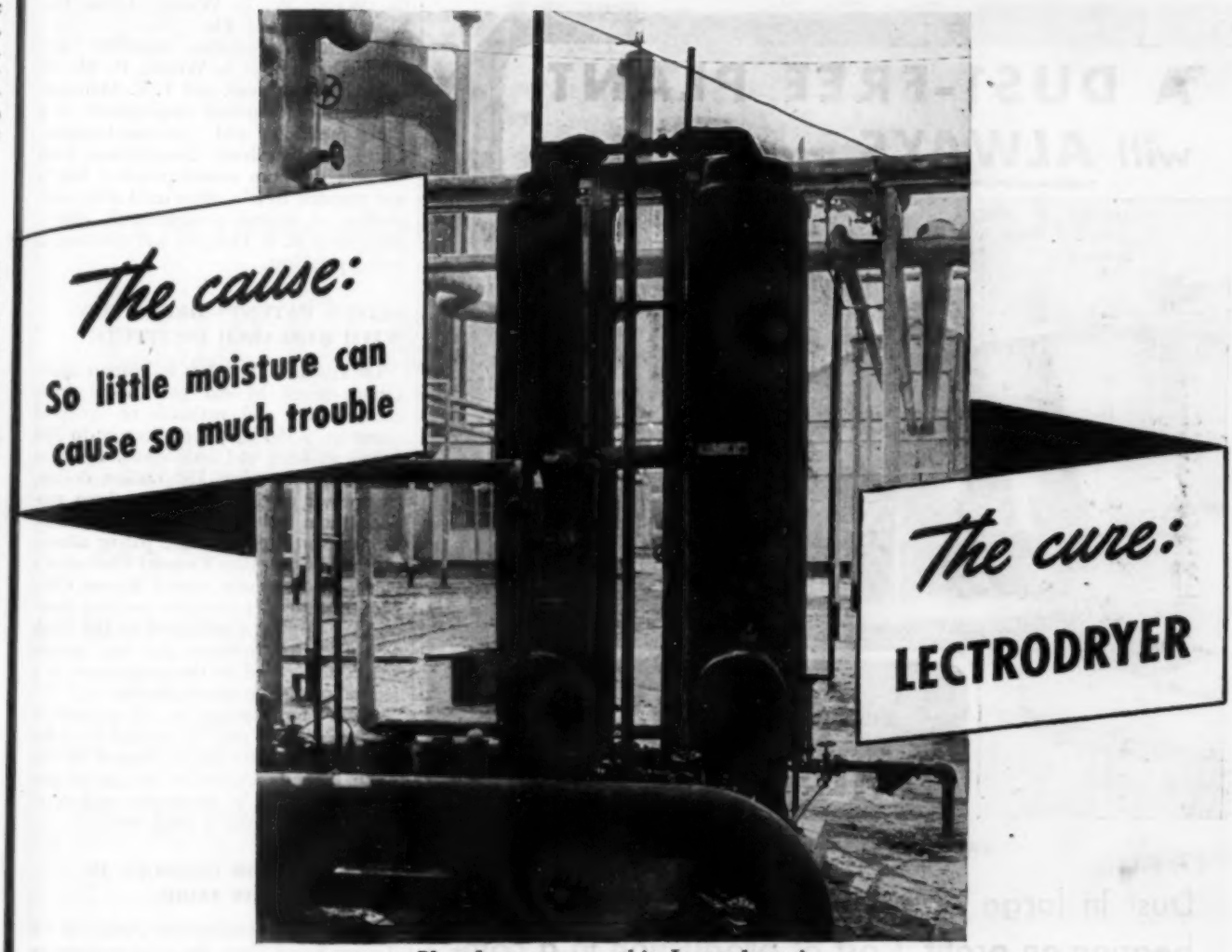
FERTILIZER INDUSTRY FORMS PLANT FOOD COUNCIL

THE American Plant Food Council, Inc., held its first annual meeting in Washington on July 24 and named its executive committee and a board of 24 directors. Forty-one companies were represented at the meeting of the new organization. The Council decided to open headquarters in the Union Trust Bldg. in Washington on August 10.

Directors named for three years are: George Gage, Anderson Fertilizer Co., Anderson, S. C.; B. W. Haynes, Wilson & Toomer Fertilizer Co., Jacksonville, Fla.; J. A. Howell, Virginia-Carolina Chemical Corp., Richmond, Va.; F. S. Washburn, American Cyanamid Co., New York; T. E. Milliman, Cooperative G.L.F. Soil Building Service, Inc., Ithaca, N. Y.; G. E. Petitt, Potash Co. of America, New York; C. B. Robertson, Robertson Chemical Corp., Norfolk, Va.; J. E. Sanford, Armour Fertilizer Works, Atlanta, Ga.

Directors of two-year terms: H. M. Albright, United States Potash Co., New York; R. B. Douglass, Smith-Douglass Co., Norfolk, Va.; D. P. Granberry, Laurel Oil & Fertilizer Co., Laurel, Miss.; W. T. Steele, Jr., Cooperative Fertilizer Service, Inc., Richmond, Va.; A. D. Strobhar, Southern Fertilizer & Chemical Co., Savannah, Ga.; W. T. Wright, F. S. Royster Guano Co., Norfolk, Va.; J. A. Woods, Chilean Nitrate Sales Corp., New York; Edwin Pate, Dixie Guano Co., Laurinburg, N. C.

Directors of one-year terms: E. A. Brandis, Standard Chemical Co., Troy, Ala.; R. R. Hull, I. P. Thomas & Son Co., Camden, N. J.; C. G. Crockett, Standard Fertilizer Co., Williamston, N. C.; W. C. Stark, Atlantic Fertilizer Corp., Riverhead, N. Y.; A. F. Pringle, A. F. Pringle & Co., Charleston, S. C.; R. C. Simms, Naco Fertilizer Co., New York; Mac C. Taylor, Oregon-Washington Fertilizer Co., Seat-



Placed on-stream, this Lectrodryer is DRYing propane at 250-pound pressure

If unwanted moisture creeps into a process, reactions are quite likely to go haywire. Lectrodryers remove that moisture. Processors then work with materials and in atmospheres of known DRYness. Reactions are easier to hold on the straight and narrow path.

That's why Lectrodryers are standard equipment in so many war-born processes . . . Lectrodryers placed on-stream in production lines. Industry had to have the surer, faster methods thus obtained.

Air, gases and many organic liquids are dried DRY by Lectrodryers. Standard machines are usually suitable for these assignments but, where special equipment is required, Lectrodryer engineers can solve those problems, too. PITTSBURGH LECTRODRYER CORPORATION, 303 32nd Street, Pittsburgh 30, Pennsylvania.

In England: Birmingham Electric Furnaces, Ltd., Tyburn Road, Erdington, Birmingham.
In Australia: Birmingham Electric Furnaces, Ltd., 51 Parramatta Road, Glebe, Sidney.

LECTRODRYERS DRY WITH ACTIVATED ALUMINAS

PITTSBURGH
LECTRODRYER
CORPORATION

Reg. U.S. Pat. Off.

tle, Wash.; W. L. Waring, Lyons Fertilizer Co., Tampa, Fla.

Executive committee members are: R. B. Douglass, J. A. Woods, H. M. Albright, J. E. Sanford, and T. E. Milliman.

Directors authorized employment of a paid president and secretary-treasurer. Clifton A. Woodrum, Congressman from Virginia has been named president but is not expected to take office until after completion of certain congressional duties. Meanwhile R. B. Douglass will continue as acting president.

SEIZED PATENTS DEPOSITED WITH RESEARCH INSTITUTE

Of the 45,000 patents and patent applications seized by our government from enemy aliens and nationals of occupied countries, 9,366 have been licensed to 760 American firms and individuals. Products valued at more than 150 million dollars, largely war goods, already have been produced from them. This was announced by Dexter North, chief of the patent administration of the Alien Property Custodian's office, who recently visited Kansas City, Mo., to turn over complete working drawings on this huge collection to the Midwest Research Institute, the only private agency to be used by the government as a repository for the seized patents.

Rights for lifetime use of patents of enemy countries may be secured for a fee of $15. The same fee is charged by the Alien Property Custodian for use of patents originating in non-enemy and occupied countries, plus a small royalty.

ORGANIZATION CHANGES IN TUBIZE RAYON CORP.

Extensive organizational changes in the Tubize Rayon Corp. designed to mobilize the company's administrative forces in anticipation of postwar growth, have been announced by its president, J. E. Bassill. The announcement was made at a luncheon which also served to honor Mr. Bassill's twenty-fifth year of service.

Leonard Kuvin becomes director of the economics division. For the last two years he has been director of economic research and now will also serve as administrative assistant to the president. Jack Wolff, recently with the U. S. Maritime Commission, is the new director of industrial and human relations division. R. C. Jones, formerly manager of the plant at Rome, Ga., will have charge of the yarn division which now handles sales as well as production. The technical division is headed by C. R. Dolmetsch, who had been assistant director of technical research and more recently technical assistant to the president. Harry Gold, vice-president, is in charge of the fabrics division.

W. E. Crooks succeeds to the position of manager at the Rome plant with J. F. Caylor as assistant. Reginald Hayes becomes superintendent of the Hopewell, Va., plant with Herman L. Weisler being transferred to the fabrics division where he will act as assistant to the vice-president in charge.

All of the executives, except those engaged in plant work, will make their headquarters in the New York offices of the corporation.

PACIFIC PROCESS INDUSTRIES

TRENDS • EVENTS • DEVELOPMENTS

JOHN R. CALLAHAM, Pacific Coast Editor, San Francisco, Calif.

GROWTH OF MANUFACTURING INDUSTRIES IN CALIFORNIA

GREATLY accelerated by the war, California's proportion of the nation's manufacturing activity, as measured by payrolls and value added to raw materials, rose from 4.3 percent in 1940 to 7.7 percent in 1943, according to data compiled by the research department of the California State Chamber of Commerce, San Francisco. The annual average number of wage and salary workers employed in manufacturing rose from 381,000 in 1939 to some 1,134,000 in 1943, when the peak of war industry employment was reached. Estimates on postwar total employment in manufacturing range from 535,000 to 610,000.

WYOMING ALUMINA PLANT BEGINS OPERATIONS

SCHEDULED to begin initial operations during September, the $4,000,000 DPC financed alumina plant of Monolith Portland Midwest Co. at Laramie, Wyo., will use a unique lime-soda sinter process with anorthosite-containing shale as the raw material. The compact plant, to be operated by Monolith, was designed and constructed by the Dorr Co. The process, largely the work of D. R. Williams, Monolith's chemist at Laramie, was developed at the instigation of the cement firm because the shale contained too much alumina to be perfectly satisfactory in cement production; alumina is actually a byproduct.

Anorthosite raw material, of which extensive deposits can be mined cheaply only 17 miles from the plant, is a sodium-calcium aluminum silicate of the feldspar group. It has been stated that a daily feed of 700 tons will produce 60-75 tons of alumina and approximately 450 tons of

other material to be utilized in the making of cement by Monolith.

KAISER FORMS SYNDICATE TO NEGOTIATE FOR STEEL

ACTING upon the suggestion of the Surplus Property Board that westerners form a company to purchase the Geneva steel plant for the government, Henry J. Kaiser has announced formation of a syndicate of western financial and industrial interests, to be known as the Kaiser Syndicate, which would negotiate to purchase and operate a $350,000,000 iron and steel industry in the west. Included in Kaiser's bid, which was sent to DPC in Washington, was a proposal to lease and operate the $180,000,000 Geneva steel plant at Provo, Utah. The 252 Koppers-Becker byproduct coke ovens at Geneva could become an important source of coal tar, ammonium sulphate, light oil, benzol and other chemicals for western industry.

LOS ANGELES INDUSTRIAL EXPANSIONS CONTINUE

DURING the month of June, total investment of 35 new plants and plant expansions in Los Angeles county exceeded $2,000,000 to bring total investments for the year to approximately $20,500,000, only 5 percent less than for the corresponding period of 1944. The number of new factories totalled 9, according to George J. O'Brien, chairman of the industrial development committee of the Los Angeles Chamber of Commerce, involving an investment of over $500,000 while the remainder represented expansions of existing factories.

NEW GLASS FACTORY FOR CALIFORNIA

GLASS CONTAINERS, INC., subsidiary of Fibreboard Products, Inc., San Francisco, has announced that construction work will begin soon on a new glass container factory in Antioch, Contra Costa County, Calif. Construction will require six or seven months. The company has been operating a glass container plant for some time at Los Angeles.

NEW CHEMICAL PLANT TO PRODUCE GLUTAMATES

WITH construction under way on three large storage tanks for the International Minerals & Chemical Corp. of Chicago at its 27-acre site near San Jose, Calif., it has been reported that the company's plans call for a $1,000,000 glutamate plant at this location. Work on the plant is expected to start in the near future, with operations scheduled for next year. The San Jose plant, first of its kind in the west, will produce monosodium glutamate from the protein of concentrated beet sugar waste liquors of California sugar refineries. The chemical is widely used to impart a meaty flavor to certain types of food products.

DDT IN PAINT MAY SOLVE PROBLEM OF BARNACLES

DDT, the powerful new insecticide, may be the answer to the age-old problem of barnacles on ship hulls, states R. E.

Dimick, Oregon State College, Corvallis. Working at the Yaquina Bay fisheries laboratory, Prof. Dimick combined DDT with ordinary marine paint and found that hulls remained free from barnacles as long as the treated paint lasted. Submerged panels thus treated completely repelled barnacles for six months, while panels coated with the best commercial anti-fouling paint became encrusted in three months. Prof. Dimick, who is also testing the paint against wood borers and other pests, is taking out patents on the process.

ADHESIVES RESIN PLANT FOR PACIFIC NORTHWEST

Reichhold Chemicals, Inc., of Detroit, plans immediate construction of a large synthetic resin plant in Seattle, Wash., it was announced during July. Production of adhesives for plywood and timber lamination and of alkyd resins for protective coatings is expected to begin late this year. Research laboratories will be maintained at the Seattle plant, according to T. S. Hodgins, Pacific Northwest manager for the company. Reichhold now has one other manufacturing plant on the Pacific Coast at South San Francisco.

SAN FRANCISCO ENGINEERS WANT WAGNER ACT AMENDED

Charging that the Wagner Labor Relations Act tends to amalgamate professional workers in a "labor front" and to merge technologists and technicians in bargaining units, the San Francisco Engineering Council has recommended that its member societies, through their respective national organizations, initiate a campaign to amend the Wagner Act so that it will insure genuine freedom to technologists in matters relating to collective bargaining. The Council urges authorization by Congress of a complete classification of positions in the fields of technology that will establish a statutory line of demarcation between technologists and technicians. It demands that all technologists be permitted to waive or exercise the rights of self-organization and designation of representatives in fully autonomous bargaining units restricted to and controlled by technologists.

PETROLEUM-NATURAL GAS OUTPUT INCREASED

Crude petroleum produced in California during 1944 amounted to a total of 311,718,000 bbl. valued at $330,660,000 at the well, reports W. W. Bradley of the California Division of Mines, San Francisco. This was the largest annual yield of crude oil ever reported in this state and compares with the 1943 output of 284,146,000 bbl. Kern county was first in production with 92,694,000 bbl., Los Angeles second with 88,646,000 bbl.

During 1944 there were 467,743,000 M cu. ft. of natural gas, worth $31,797,000, produced and utilized (sold or used) in California compared with 443,220,000 M cu. ft. in 1943. The 1944 output of utilized natural gas was the largest annual yield on record in this state. Sacramento county was first with 72,644,000

M cu. ft. while Kern was second with 72,111,000 M cu. ft.

WESTERN VERMICULITE OUTPUT INCREASES

DOMESTIC production of vermiculite during 1944 increased to 54,116 short tons, according to the U. S. Bureau of Mines, as compared to the output during 1939 of 21,174 tons. Bulk of the production in 1944, as in previous years, came from the Universal Zonolite Insulation Co. mine at Libby, Mont. Several new companies carried on development work in Colorado in 1944 and were expecting to produce during 1945. Most vermiculite reaches the consuming market in the exfoliated form.

ALCOA MAY USE OREGON CLAYS

POSSIBILITY that the Aluminum Co. of America may abandon its postwar plans to construct a Bayer bauxite plant at Vancouver, Wash., and instead construct a unit for the manufacture of alumina from domestic ores on the Oregon side of the Columbia river were voiced recently by Arthur P. Hall, vice president of Alcoa and chairman of the company's postwar planning committee. The decision depends on the outcome of experiments now under way on high-alumina clays recently discovered in Washington county, Ore. Either of the two facilities under consideration would be used to feed alumina into the company's reduction plant at Vancouver.

PACIFIC PROCESS INDUSTRIES TO EXPAND IN POSTWAR

CHEMICAL and process industries of the Pacific Coast states expect to retain a large part of their wartime gains, a survey reported by the Federal Reserve Bank of San Francisco reveals. Based upon a canvass of manufacturers made during mid-1944, the survey showed that the chemicals and allied products industries plan to spend between $10-20 million in the early postwar period, about half of which would represent new plant construction. The estimated postwar outlays of selected west coast industries are summarized in Table I.

Postwar employment expected by west

Table I—Estimated Postwar Outlays of West Coast Manufacturers

	Outlays in Millions		Percent of Total			
	Min.	Max.	Purchase of Gov't. Property	New Plant Const.	Structural Additions & Repairs	All Other
Food & kindred prod.	$26	$36	..	48	23	29
Chemicals & allied prod.	10	20	1	52	20	18
Petroleum & coal prod.*	21	29	..	60	40	..
Machinery (except electrical)	21	22	5	11	5	79
Electrical machinery	3	6	17	1	6	76
All industry**	$201	$433	3	16	20	61

* Including oil production, transportation, storage and refining. ** Excluding steel mills and nonferrous metals.

coast manufacturers of chemicals and allied products under good general business conditions will amount to almost 23,000 as compared to 17,000 employed in 1939 and the wartime peak of 26,500 in 1943. The greatest percentage gain over 1939 is expected in the field of drugs, toilet preparations and insecticides. Expected postwar employment of manufacturers by selected industries is shown in Table II.

ELECTRONIC CHEMICAL ENGINEERING FIRM ORGANIZES

RECENTLY organized for the purpose of conducting pure and applied research in the electronic-chemical field is the Electronic Chemical Engineering Co. of Los Angeles, Calif. With a staff of about 15 research engineers and scientists and several laboratories in Los Angeles, the firm specializes in developing electronic-chemical processes for Pacific Coast industry, particularly in the fields of beverages, food and food products, wood and wood products. One process consists of the dielectric precooking of foods prior to fast freezing. Most recent development is a method for the sterilization and pasteurization of several food products in which the heat developed seems to be secondary to an "electronic catalytic effect" as yet little understood.

Partners in the firm are Dr. Ferenz H. Fodor, director of research; Kenneth A. Smith, field engineer; Robert P. Sibley, production and sales engineer; Dr. Alexis Pantaleoni, business manager. The firm does not intend to engage in manufacturing operations of any kind.

Table II—Expected Postwar Employment of West Coast Manufacturers[1] (As Thousands of Employees)

	Pacific Coast			California			Oregon & Washington		
	1939	1943	Postwar	1939	1943	Postwar	1939	1943	Postwar
Lumber & timber products	111.9	105.7	136.1	24.2	26.1	25.7	87.7	79.6	110.4
Paper & allied products	19.5	23.7	22.2	6.7	8.2	7.6	12.8	15.5	14.6
Chemicals & allied products	17.1	26.5	22.9	15.3	23.8	20.4	1.8	2.7	2.5
Paints, varnishes & colors	3.0	3.7	3.4	2.7	3.3	3.1	0.3	0.4	0.3
Drugs, toilet prep. & insecticides	3.4	5.4	4.4	2.3	5.0	4.0	0.2	0.4	0.4
Industrial chemicals	6.7	9.1	7.6	5.9	8.1	6.7	0.8	1.0	0.9
Other chemical products	5.0	8.3	7.5	4.5	7.4	6.6	0.5	0.9	0.9
Petroleum & coal products[2]	26.6	25.9	29.3	26.3	25.6	29.0	0.3	0.3	0.3
Rubber products	6.4	20.1	9.4[3]	6.3	19.9	9.3[3]	0.1	0.2	0.1[3]
Leather & leather products	3.4	5.1	5.0	2.9	4.3	4.2	0.5	0.8	0.8
Machinery (except electrical)	23.5	72.7	52.3	10.2	50.3	42.7	4.3	13.4	9.6
Electrical machinery	5.6	24.0	15.0	5.2	22.4	13.9	0.4	1.6	1.1
All industry[4]	534.1	733.6	704.9	347.4	523.1	474.9	176.7	210.5	230.0

[1] Under the assumption of good general business conditions. [2] Includes oil production, transportation, storage and refining. [3] Information obtained from sources other than this survey. [4] Exclusive of shipbuilding and aircraft.

NEWS FROM ABROAD

PROGRESSIVE DE-CONTROL MARKS TRANSITORY STAGE OF BRITISH CHEMICAL INDUSTRY

Special Correspondence

THE PROCESS of de-control is making rapid progress in Great Britain. In June nitric acid and ammonia, bentonite and fuller's earth, fluorspar and asphalt rock, and cadmium have come off the list of controlled commodities. The restrictions on essential oils will be removed as soon as possible in consultation with the trades concerned. Licenses are no longer needed for small lots of acetic acid, acetic anhydride, acetone, and amyl, butyl and ethyl acetate and alcohol. Export regulations have been relaxed for a long list of chemicals. The license-free limit for benzol and coal spirit sales have been raised. Metal merchants can effect small sales abroad without specific control authorization.

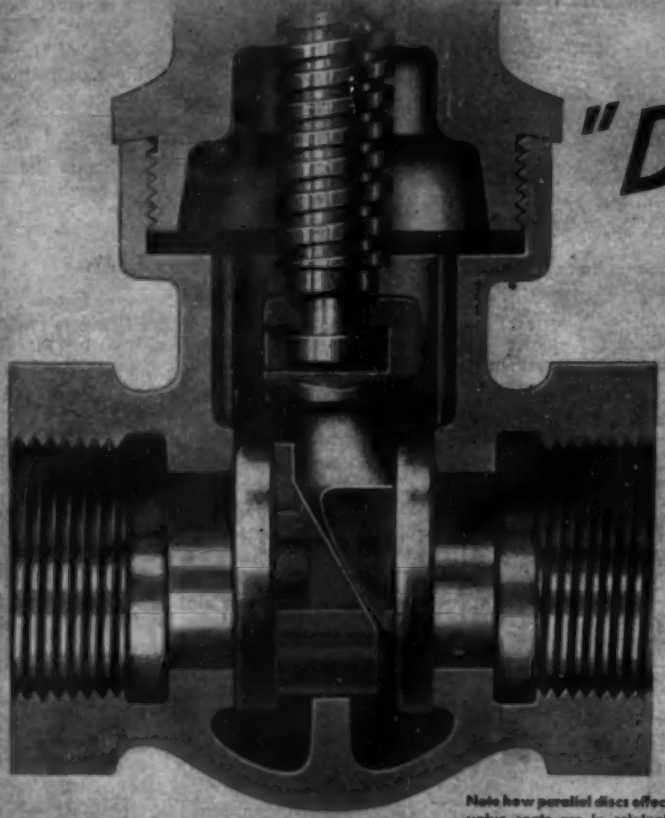
Parallel with the process of de-control, a number of price adjustments have been carried out in preparation of further relaxations. The price cut for aluminum has been followed by a price advance for lead and zinc. This in turn has been reflected in the official quotations for lead and zinc compounds. The prices of benzol, xylol and coal spirit have been raised. Similarly the price of mica has been revised to meet the advance in producing costs. Butyl synthetic rubber, on the other hand, has become cheaper. The maximum prices for certain types of scrap and waste metal have been lifted.

The most important of these price corrections bring British home market prices into line with quotations in the world market and with producing costs of British and foreign makers. There is no doubt that these adjustments were made in order to smooth the way for a gradual return to free commerce. While all purchases and sales were effected through controls over manufacturers working mainly on government contracts, there was no need for price alterations but, on the contrary, every reason to keep prices stable and to avoid the complications resulting from frequent changes.

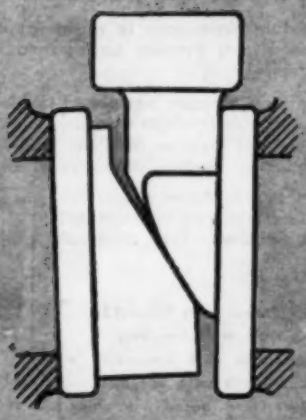
If, however, the artificial price levels thus maintained were to become the starting point for a resumption of free dealings in an unfettered market, the removal of control would automatically and immediately be followed by violent price fluctuations which would prove a serious handicap for free trade. It is chiefly for this reason that the Ministry of Supply is effecting the necessary price alterations before handing over to private enterprise.

With the same aim in view, import duties at prewar rates have been restored

DARLING...the valve that can give you "DROP-TIGHT" SEATING...



Note how parallel discs effect tight closure when valve seats are in original parallel position.



This greatly exaggerated diagram shows how the curved face of the upper wedge allows the discs to fit against seats, "unparalleled" by valve body distortion.

Darling manufactures a quality line of gate valves for long service—in parallel seat or tapered seat—slotted or solid wedge types—for service pressures up to 3000 pounds. Valves are available in cast iron, bronze, cast steel, forged steel, corrosion resisting and special alloys. Darling also manufactures check valves, compression type fire hydrants, motor and cylinder operated valves, and accessories.

THERE is one gate valve design that insures "drop-tight" seating, year after year. It is the unique Darling design. Darling's fully revolving double disc parallel seat gate valve provides:

1. ADAPTABILITY—Any valve can close tight the day before it is installed. But the day after is another story. Pipe out of alignment and bolting strains distort valve bodies. Pressure and temperature changes and other operating strains force valve bodies out of shape, too, so that gate and seats do not remain parallel.

To compensate for "unparalleled" seats, in the Darling valve wedging assembly a straight or tangent surface on the lower wedge acts on a curved or "radius" surface on the upper wedge. So no matter what position valve seats reach in years of usage, the Darling twin discs make perfect closures.

2. UNIFORM WEAR—The twin discs are free to revolve 360°, seating in a different position each time the valve is operated. Wear on discs and seats is uniform, making possible tight closing year after year.

3. INSTANT RELEASE—The four simple parts of the valve assembly—two discs, two wedges—release at the first fractional turn of the stem to open. The gate is immediately free to rise with little or no friction.

For over 40 years engineers have found that Darling Valves give "drop-tight" shut-off, long life and low maintenance.

NOW—when maximum uninterrupted production is all-important—you can safeguard it by installing Darling Valves. Later, when low-cost operation and maintenance are vital, you will be all set with valves that help you keep costs down and help you compete in postwar markets.

TRADE DARLING MARK

DARLING VALVE & MANUFACTURING CO.
WILLIAMSPORT, PA.

on a number of important goods for which duty-free licenses were granted to private importers in wartime when these classes of merchandise were predominantly imported for government purposes and exempted from duty as a matter of administrative convenience. Some of these import duties are intended as a protection for British makers of similar goods. As the need for such protection continues, the system of protective duties will for the time being be retained, though there is a clear case for a complete overhaul of this protection.

RISE IN COSTS

British chemical manufacturers are not in favor of such artificial help. They fear, however, that the rise in the cost of raw materials and fuels will place them at a considerable disadvantage as compared with foreign producers. B. Laporte Ltd., to give data for a medium-sized firm as an example, has just reported that the firm pays 50 percent more for electricity than in 1938, 65 percent more for coal, and 80 percent more for coke. The average quality of the fuels has declined, raw and other materials of prewar standard types and qualities have not always been available, and there is little possibility in today's circumstances of improving and extending plants. These difficulties are facing all British chemical manufacturers and are regarded with grave misgivings.

The supply situation has eased slightly, but in most fields demand is still greatly in excess of supply. Restoration of more normal conditions in the liberated countries of Europe, the visits of trade delegations from neutral countries with which contact can now be re-established, the improvement in the shipping position, and the relaxations of export regulations—all these factors have helped to improve the tone in the export market, but the actual flow of business is still rather slow and weak on account of the shortage of supplies.

The undertone of the home market remains definitely strong, and this applies also to those sections which in prewar days suffered from an excess of supplies. The production of chemical fertilizers is likely to benefit from smaller explosives requirements and bigger shipping tonnages, but British farmers are still urged to take early delivery because home supplies may have to be restricted in the interest of farmers in Continental countries. The wartime policy of standardization has proved so successful that the concentration of manufacture on a limited number of standard products will be continued for some time. The lime subsidy has been raised for deliveries this summer and seems to become a permanent fixture; the value of giving additional lime has been proved beyond doubt on most British soils.

The release of war factories for civilian production is progressing. In July 34 such plants have been released; one of them, in Cumberland, will make cellulose acetate yarn for Courtaulds, while another factory, at Dundee, will produce plastic molding powder for B. X. Plastics Ltd. There are of course cases where conversion meets with difficulties. The magnesium factory near Burnley, built at a cost of over

£4,000,000, has been idle for many months, but owing to its special construction and the heavy plant which it contains it cannot be readily made available for other forms of production and can therefore only be used for storage purposes unless it is reopened for its original purpose.

A considerable time lag must necessarily arise between the stoppage of war production and commencement of peacetime manufacture, and this interval is often lengthened by unavoidable delay in repair and re-equipment. Quite a number of these redundant factories will directly or indirectly help to solve the housing problem. Some of them may be used for the manufacture of fertilizers. New superphosphate factories are to be erected in the British Isles to replace U. S. triple phosphates obtained under lend-lease arrangements.

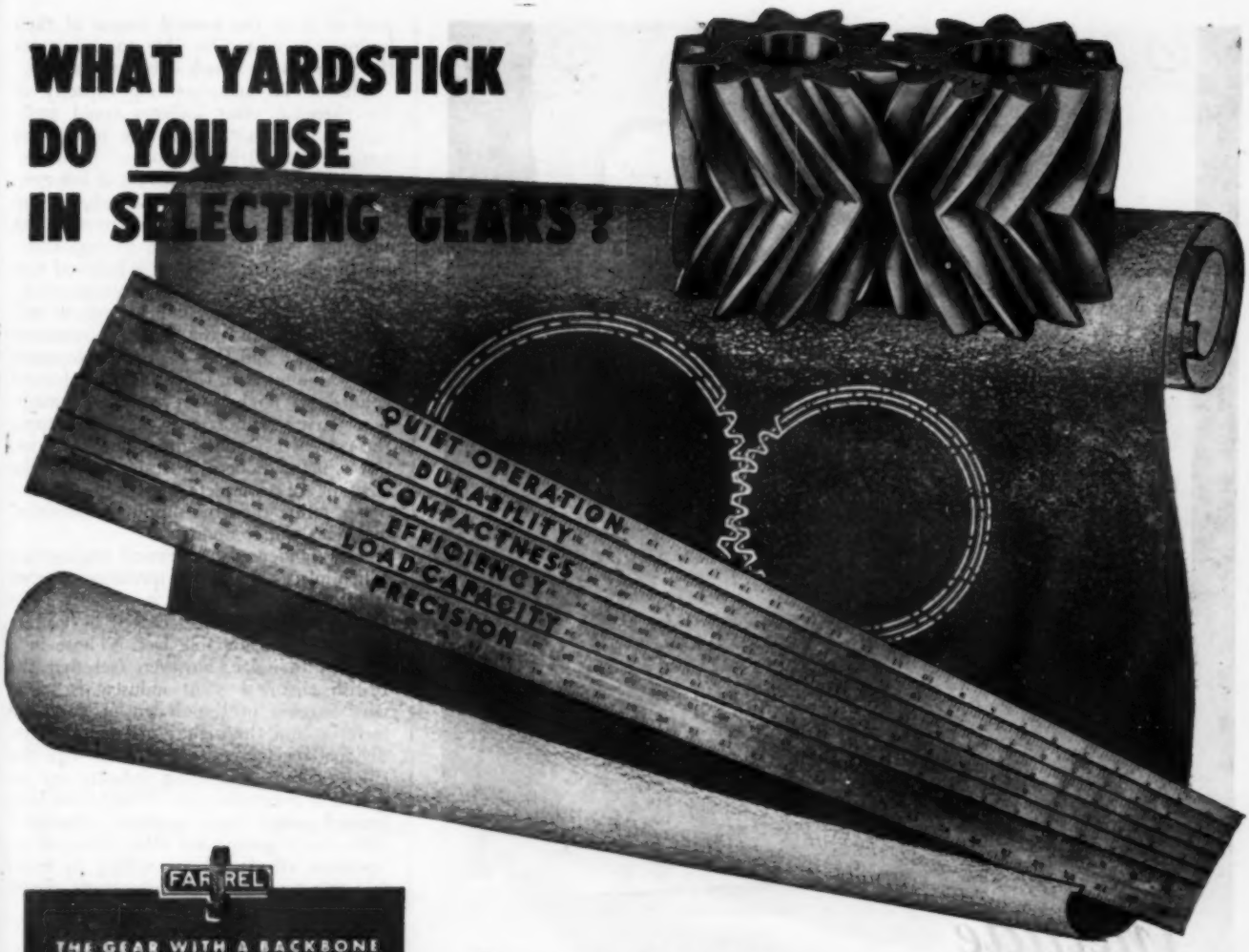
NEW PROJECTS

Artificial fibers and plastics soon will be produced in several new factories. A new Courtaulds plant to produce continuous filament viscose yarns is to be built in Northern Ireland. Work on this factory, scheduled to cost several million pounds, will begin in August. Dunlop may enter this field too; at the shareholders' meeting it was stated that the company was alive to the potentialities of synthetic fibers and plastics.

Dunlop has substantially completed its program of replacing natural by synthetic rubber in all products where the synthetic material can be used, but experts are not very enthusiastic about the results. The change-over has been made without much embarrassment to Dunlop customers, but it has thrown an enormous amount of work on factory, engineering and technical staffs and the Dunlop chairman does not believe that "any manufacturer would willingly use synthetic rubber to any extent if natural rubber were available." When more natural crude rubber becomes available, the supplies will be in the opinion of experts have to be shared between the United States and Great Britain. The Dunlop chairman suggests that when the two types of rubber are in greater supply the whole matter should be discussed so that no country is prejudiced as compared with another.

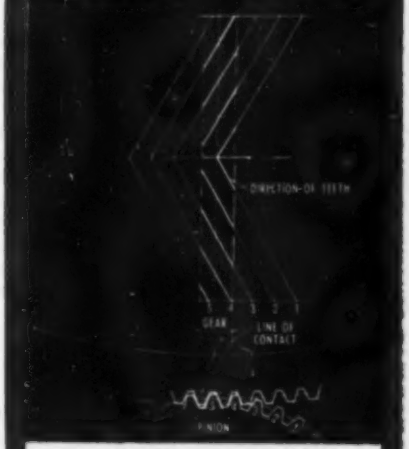
Discussions have been held between chemical plant manufacturers and government departments interested in the disposal of surplus war plants. A great deal of such equipment is now coming on the market. The Air Ministry, for instance, is offering a number of plants of varying capacities for the production of hydrogen, blue water gas, etc. Some of these plants are offered for sale as complete installations, while others will be broken down into their component parts. Such offers and arrangements are, of sourse, fairly general, and British chemical plant manufacturers are afraid that their market may be swamped with equipment, made to meet specific wartime requirements but offered for different purposes, with consequent detriment to the reputation of the designer and manufacturer. It is thought that this drawback could be avoided by selling such surplus plants to the original makers who could recondition it if necessary and dis-

WHAT YARDSTICK DO YOU USE IN SELECTING GEARS?



FARREL

THE GEAR WITH A BACKBONE



The lines of contact are oblique across the face of the teeth, and the pressure is evenly distributed over each tooth from tip to working depth line, so there is no tendency for the teeth to wear unevenly.

Diagram showing the number of interlacing teeth and the development of teeth in contact. The large number of teeth always in mesh assures uniform angular velocity.

On any basis of selection, the advantages of Farrel-Sykes continuous tooth herringbone gears—*The Gear with a Backbone*—merit the consideration of designers and engineers responsible for the correct application of gears and their successful operation.

The *backbone,* formed by the juncture of the two helices without a center groove, puts the entire face width to work and provides extra strength and higher load-carrying capacity in small space—a definite advantage for "designed-in" gears.

Precision generation by the famous Farrel-Sykes process makes these gears exceptionally quiet and smooth-running. The combined characteristics of overlap or interlacing of the teeth, creeping engagement and inclined line of pressure, reduce wear and maintain the involute profile and correct tooth action throughout a long gear life. Opposed helices balance and absorb axial thrust within the gear member, eliminating harmful thrust loads and resultant stresses on other parts of the machine.

These and other features of design and manufacture contribute to dependable performance, continuous operating efficiency and maintenance economy.

We shall be glad to have a Farrel engineer give you further details of the *Gear with a Backbone,* or send you a copy of a descriptive booklet, No. 438. No obligation.

FARREL-BIRMINGHAM CO., INC. 344 VULCAN ST. BUFFALO, N. Y.

Plants: Ansonia, Derby and Stonington, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Pittsburgh, Akron, Los Angeles, Tulsa, Houston, Charlotte

Farrel-Birmingham

pose of it in the normal course of their business to customers able to use it for the purposes for which it is really suited.

The whole manufacturing capacity of the chemical plant industry could probably be used with advantage to provide equipment for British factories. Such concentration on the home market is, however, discouraged by leaders of the industry and government agencies on the grounds that advantage should be taken of opportunities in the export field. It is believed that many overseas countries in a comparatively early stage of industrial development will wish to establish basic chemical industries of their own and that such a development is in the interest of the principal industrial countries. To help in this development, plant manufacturers may have to supply the complete equipment of new factories, just as many modern processes demand the erection of complete and self-sufficient plants rather than the supply of individual machines and components.

This tendency in chemical engineering which places the small specialized manufacturer at a disadvantage is, of course, well known and has been accepted by leading firms as an unalterable fact. Those in a position to judge, however, feel that the British chemical plant industry is somewhat lagging in the design of complete factories and think the "grouping" of individual makers and cooperation with the chemicals manufacturing industry are required to overcome gaps. These firms have learned much from wartime experience with export groups and other forms of cooperative effort and are willing to translate this experience into peacetime experiments.

CHILEAN GOVERNMENT AIDS PENICILLIN PRODUCTION

The Institute Bacteriologico de Chile, a semi-official organization engaged in the manufacture of biologicals, arseno-benzol and various other medicinal preparations, is now an established producer of penicillin. In April of this year, 1,000,000 paper pesos were granted to this institution by the Chilean Government for the purchase of equipment and supplies necessary for expansion of production. It is expected that future production of penicillin will be between 40,000,000 and 50,000,000 Oxford units daily.

MEXICO REDUCED EXPORTS OF NAVAL STORES

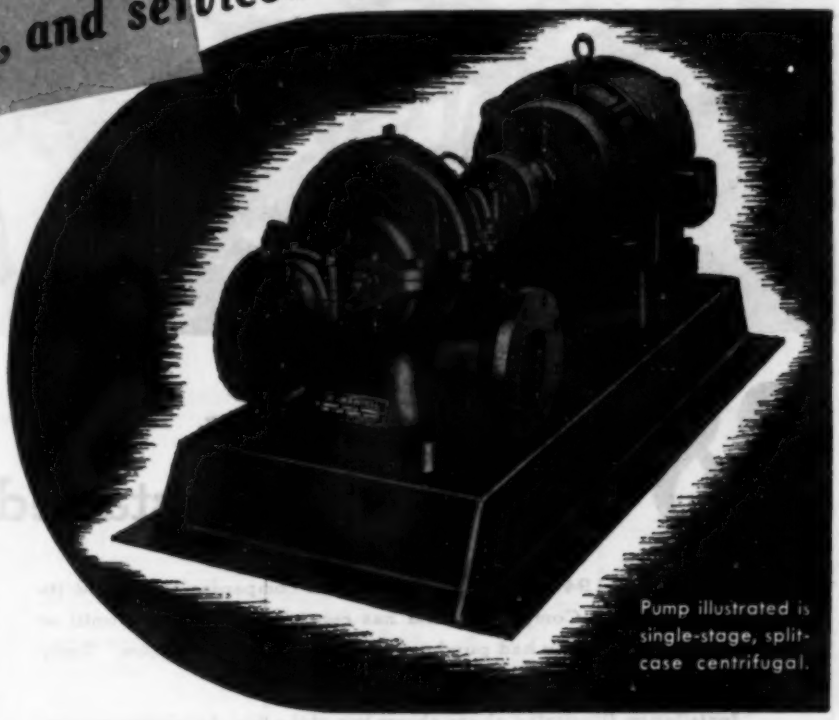
Exports of naval stores from Mexico to the United States which usually average 8,000 metric tons annually, were reduced in 1944 principally because of lowered output resulting from the damage wrought to a large part of the producing area by the eruption of the new volcano, Paricutin. The Mexican naval stores industry normally produces about 3,200 tons of turpentine and 13,000 tons of rosin per annum.

LEAD ARSENATE PRODUCTION IN ARGENTINA

Two plants in Argentina undertook the manufacture of lead arsenate in 1944. It was expected that this would make about 300 metric tons available for the spraying season. It is reported that the quality of the domestic product is inferior to im-

Complete PUMPING UNITS

. . . built, guaranteed, and serviced by ONE manufacturer



Pump illustrated is single-stage, split-case centrifugal.

Fairbanks-Morse complete pumping units offer you much more than sustained high efficiency. There are in addition these three vitally important advantages:

1. ***Combined Responsibility.*** Designed and built in one factory, pump and driver (motor or engine) are perfectly matched and covered by a single guarantee.
2. ***Successful UNIT Performance.*** Tested in one plant under expert engineering supervision, pumps and drivers assure a superior result to the buyer.
3. ***Service from One Source.*** No questions about who is to make any required repairs or adjustments.

You can get these major advantages from Fairbanks-Morse . . . because Fairbanks-Morse designs and builds all components of an outstanding line of complete pumping units. To see a qualified engineer about any pumping job, write Fairbanks, Morse & Co., Fairbanks-Morse Bldg., Chicago 5, Ill.

BUY WAR BONDS FOR KEEPS

Fairbanks-Morse

A name worth remembering

Diesel Locomotives • Diesel Engines • Generators • Motors • Pumps • Scales
Magnetos • Stokers • Railroad Motor Cars and Standpipes • Farm Equipment

ported grades. Lack of adequate stocks of lead arsenate caused considerable concern to fruit growers in view of heavy coddling-moth infestation carried over from 1943.

MANUFACTURE OF DDT STARTED IN SPAIN

Manufacture of DDT has been under way in Spain since the early part of this year. The product is being marketed by Zelita under the brand name ZZ. The materjal has appeared in several forms, including powder, liquid spray, lotion, and soap. The powder and the liquid are prepared both for home and large-scale agricultural use. Present capacity of the factory is 150 lb. of the pure ingredient daily and from three to six tons of products are made every day. The company expects sales to reach 3,600,000 pesetas during the first year.

CARBON BISULPHIDE PLANT PLANNED FOR TURKEY

It is reported that equipment already has been ordered for installation in a new plant at Gemlik, Turkey, which is to make carbon bisulphide. The output of the plant will be small as it is intended to satisfy the needs of a rayon plant which is located at Gemlik.

TANNERIES ON FULL-TIME BASIS IN MEXICO

Tanneries in Mexico worked on a full-time basis throughout the first quarter of 1945 as demands for all kinds of leather for domestic use continued strong. One of the largest tanneries in the country was completely destroyed by fire during the quarter. Steps were immediately taken for replacing the plant.

SURINAM HAS LARGE STOCKS OF MINED BAUXITE

Bauxite mining in Surinam suffered from lack of demand and scarcity of shipping space during 1944. Production for the year totaled 626,000 metric tons as compared with 1,655,000 metric tons in 1943. The three bauxite mines operated with a reduced staff and on an eight-hour shift during the year. Nevertheless, large stocks accumulated awaiting shipment. Because of a bar at the mouth of the Surinam River, ships loading bauxite at interior mines were obliged to leave Paramaribo partially loaded, completing their cargoes at Trinidad where stockpiles were maintained. A channel has now been dredged to the sea.

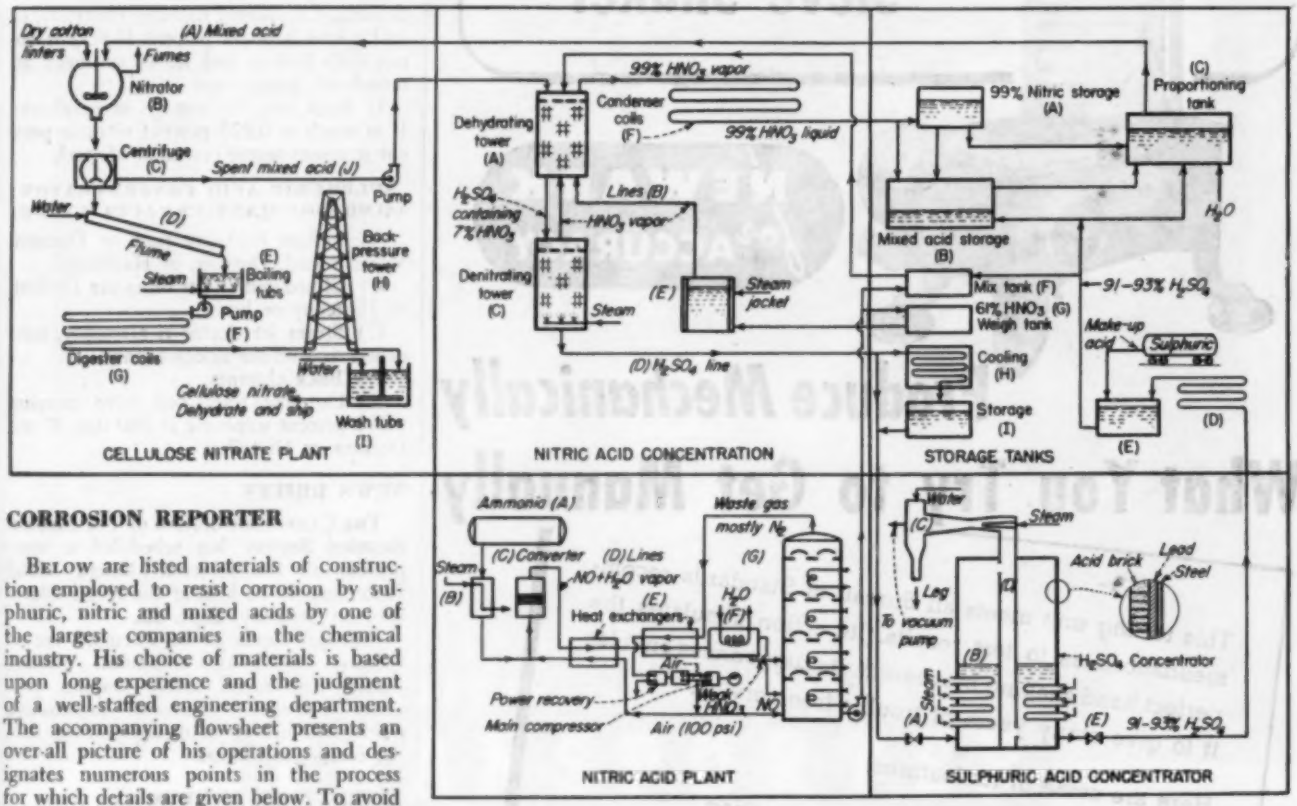
FRENCH MOROCCO PHOSPHATE INDUSTRY MORE ACTIVE

Limited railroad capacity for hauling material from the mines at Louis Gentil to the port of Safi, had an unfavorable effect on the phosphate rock trade of French Morocco last year. Despite the limiting factors, production of rock was on a relatively high level as about 1,500,000 metric tons were mined in 1944. The monthly rate of output was considerably higher at the end of the year than at the beginning. The upturn in the latter part of the year appeared to promise a continued increase during 1945. However, production in 1944 did not meet the goal and prospects of reaching the figure of 2,500,000 tons fixed for 1945 are not promising.

CORROSION FORUM

EDMOND C. FETTER, Assistant Editor

MODERN MATERIALS • MODERN METALS



CORROSION REPORTER

BELOW are listed materials of construction employed to resist corrosion by sulphuric, nitric and mixed acids by one of the largest companies in the chemical industry. His choice of materials is based upon long experience and the judgment of a well-staffed engineering department. The accompanying flowsheet presents an over-all picture of his operations and designates numerous points in the process for which details are given below. To avoid confusion in going back and forth between flowsheet and text, it should be noted that each of the five sections into which the plant is divided has its own set of ABC key letters.

CELLULOSE NITRATE PLANT

A) Steel piping, fittings, pumps; closed system—no chance for air to enter or water to collect. Mixed acid range: sulphuric, 40-60; nitric, 40-20; water, 15-20 percent.

B) Nitrator vessel, agitator, fittings made of stainless steel Types 430, 304, or 316* interchangeably.

C) Centrifuge basket made of steel now, probably will be replaced with stainless Type 347.

D) Terra cotta flume has been in service for 25 yr., but will be replaced with stainless Type 304 to eliminate breakage and joint maintenance. Here the nitrated fibers are flooded with water, reducing acidity to about 1-2 percent.

E) Boiling tubs are wood, lined with stainless Type 316; steam distributor is also 316. Leaves tubs at about 125-210 deg. F. with acidity diluted by steam to about 0.5 percent.

F) Casing and impeller of pump are Type 430 or 304.

G, H) Digester coils (nearly mile-long) and tower line are Type 430 and 304.

I) Wash tubs, like boiling tubs, are wood, lined with Type 316.

J) Spent acid lines and fittings are steel, pump is Type 304. Acid content is usually about 63 percent sulphuric, 18 nitric.

NITRIC ACID CONCENTRATION (ZEISBERG SYSTEM)

A) Dehy. tower is Duriron throughout.

B) Vapor lines are also Duriron.

C) Denitrating tower is of steel-lead-brick construction as shown in "magnification" of the sulphuric acid concentrator. Distributor plate at top and steam distributor at bottom are Duriron.

D) Lines are lead or Duriron. Acid is boiling as it leaves denitrating tower, concentration is 66-68 percent.

E) HNO_3 evaporator is Duriron.

F) Condenser-cooling coils are Duriron. Acid leaves coils at about 125 deg. F.

NITRIC ACID PLANT

A) Anhydrous ammonia storage tanks are steel.

B) Ammonia evaporator is steel.

C) Converter where the following reaction takes place: $4NH_3+5O_2 \rightarrow 4NO+6H_2O$. Converter is stainless Type 430; catalyst is Pt-Rh gauze. Converter operates at about 1,700 deg. F.

D) Vaporlines are stainless Types 304 or 430. Throughout the entire nitric acid plant Types 304 and 430 are used more or less interchangeably, availability usually being the determining factor.

E) Heat exchanger tubes are Type 304 or 430.

F) Cooler-condenser is Type 304 or 430.

G) Absorption tower is Type 430; 61-percent nitric is produced. Out-flow pump may be Duriron, Worthite, or Type 304.

STORAGE TANKS

A) Nitric acid storage tank is stainless Type 347. Nitric above 95 percent can be stored in either Cr-steel or aluminum, though aluminum is probably longer lasting.

B) Mixed acid is stored in steel, but it is imperative that the concentrated sulphuric be run in first and the nitric on top of it. Final proportions are approximately 83 percent nitric, 17 sulphuric.

C) Proportioning tanks are steel. Steel is satisfactory for mixed acid at atmospheric temperatures so long as the mixture

* Type numbers are those of the American Iron and Steel Institute. Alloy content of the types mentioned in this discussion are as follows: Type 304: 18-20Cr, 8-10Ni. Type 316: 16-18Cr, 10-14Ni, 1.75-2.5Mo. Type 347: 17-19Cr, 9-12Ni, Cb-stabilized. Type 430: 14-18Cr.

contains at least 15 percent sulphuric and no more than 25 percent water.

D) Cooling coils are lead. They receive 91-93 percent sulphuric at about 360 deg. F., discharge it at 125 deg. F.

E) Steel tank for storage of concentrated sulphuric.

F) Steel mix tank for H_2SO_4 and HNO_3 to be fed into nitric concentrator dehydrating tower.

G) Stainless Type 430, 304, or 347 for 61-percent nitric weigh tank.

H) Sulphuric acid cooling coils may be Duriron, Corrosiron, Karbate, Hastelloy, or lead. Acid is 66-68 percent H_2SO_4; it enters coils boiling and leaves at about atmospheric temperature.

I) Steel tank for storage of sulphuric. If as much as 0.025 percent nitric is present it causes severe corrosion of steel.

SULPHURIC ACID CONCENTRATOR (SIMONSON-MANTIUS VACUUM TYPE)

A) In-flow lines are lead or Duriron. Valve is lead, Duriron, or Hastelloy.

B) Closed-end steam tubes are Duriron or Hastelloy or both.

C) Steam jet ejector is Hastelloy, condenser is Everdur silicon-bronze.

D) Brick chimney.

E) Out-flow lines and valve carrying 91-93 percent sulphuric at 360 deg. F. are Duriron or Hastelloy.

NEWS BRIEFS

THE CLEVELAND section of The Electrochemical Society has scheduled a symposium on the subject, Modern Metal Protection, to be held at the Hotel Cleveland on Saturday, Sept. 22.

Principal topics to be discussed are as follows: Anodizing, chromium plating, plating base metal before shaping, porcelain enameling, postwar automotive plating, Ramsburg detearing process, rubber coating and rosins.

LITERATURE REVIEW

"RELATIONSHIPS Between Corrosion and Fouling of Copper-Nickel Alloys in Sea Water," F. L. LaQue and Wm. F. Clapp, Trans. The Electrochemical Society, April 1945, pp. 165-184:—Original data are presented to show the effect of fouling on corrosion rates and the effect of corrosion on fouling rates in the Cu-Ni alloy system when exposed to natural, flowing seawater.

"THINGS TO KNOW About Welding Stainless Steel," 23-page booklet published by The McKay Co., Pittsburgh:—A simple discussion, for welders and shop foremen, on the subject of metallurgy and heat treatment as applied to the welding of stainless steel. Points out pitfalls and tells how to escape them in everyday shop practice.

"ASRE CORROSION REPORT, 1944," American Society of Refrigerating Engineers:—A group of five papers on various aspects of corrosion with an introduction by C. F. Holske. Four of the ASRE papers were presented originally in 1943 and the fifth in 1944. Subjects and authors are as follows: fundamental concepts, R. B. Mears; selecting metals for use with particular corrosive substances, W. Z. Friend; chromate inhibitors in brine

systems, Marc Darrin; cathodic protection, R. H. Brown; organic resin coatings, G. H. Young and G. W. Seagren.

"Corrosion Research and Abatement—Yesterday and Today," F. N. Speller, *Corrosion*, March 1945, pp. 1-13

"Electrical Resistivity of Steel," R. P. Howell, *Corrosion*, March 1945, pp. 14-16.

"Economics of Mitigation of External Corrosion on Underground Pipe Lines," J. C. Stirling, *Corrosion*, March 1945, 17-30.

"Use of Forced Drainage Systems in Stray Current Areas," E. G. Carlson, *Corrosion*, March 1945, pp. 31-37.

"Failure of Spring Loops by Stress Corrosion," Given Brewer and Herman C. Ihsen, *Metal Progress*, April 1945, pp. 707-712.

"A Laboratory Machine for Investigating the Corrosion of Bearings," S. K. Talley, R. G. Larsen, and W. A. Webb, *Industrial and Engineering Chemistry, Anal. Ed.*, March 1945, pp. 168-175:—The construction and operation of the Shell thrust bearing corrosion machine are described in detail. This is a simple machine which simulates the the important mechanical conditions obtaining when corrosion occurs in engine bearings. It thus provides a laboratory tool for studying the factors which control bearing corrosion and for predicting the corrosivity of lubricants.

"Stainless Steels," *Product Engineering*, Feb. 1945, pp. 105-120:—A review of the various types of wrought stainless steels, their mechanical properties and typical examples of their use in corrosion-resistant and high-temperature applications.

"Threshold Treatment of Water," J. C. Skerrett, *Canadian Chemistry and Process Industries*, April 1945, pp. 226-229:—A summary of present practice in preventing scale and corrosion throughout steam generating systems, with emphasis on the merits of phosphate additions.

"Polyisobutylene Tank Lining," David W. Young and W. C. Harney, *Ind. and Eng. Chem.*, July 1945, pp. 675-678:—Describes a successful method for bonding polyisobutylene to steel and reports test data indicating good resistance to numerous acids and alkalis.

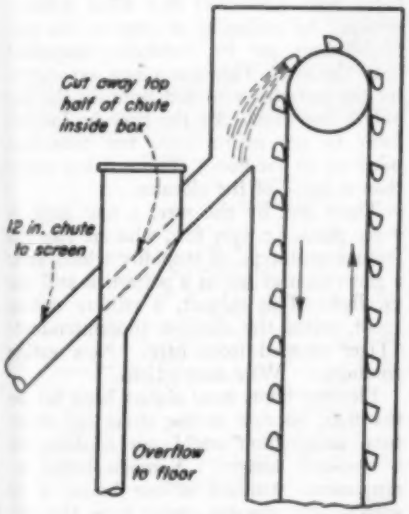
"Chlorine Takes the Bite out of Ammonia," A. E. Griffin, *Power*, July 1945, pp. 92-94+:—Test data show that chlorine added to boiler feedwater "destroys" any free ammonia present, thereby reducing corrosiveness and tendency toward biofouling of equipment.

"Theory of Stress Corrosion Cracking of Mild Steel in Nitrate Solutions," J. T. Waber, H. J. McDonald, and B. Longtin, *Trans. The Electrochemical Society*, preprint 87-32, 1945, pp. 439-461.

FROM THE LOG OF EXPERIENCE

DAN GUTLEBEN, Engineer

MICHAEL FIDUSKA had an accident one Sunday afternoon and he behaved in a manner so unusual as to warrant a record in the Log. He came racing through the melter house in search of the master mechanic. The chronicler, noting his distress, invited confession. He said that the machine under his charge had been wrecked. At an evil moment he had taken a catnap. In Michael's homeland the boss (who never made a mistake) would have fired him. In this case there were two surprises. First, the boss was surprised and refreshed to be relieved of the struggle for the solution of the mystery and could go right ahead with the replacement, using standards parts. And second, Michael was not fired.



Top of char elevator showing safety device which handles overflow if screen becomes blocked

A CHAR ELEVATOR, on the other hand, had the disconcerting habit of blocking up occasionally to the discomfort of the production department. Trouble shooter John Killian went aloft to determine the cause. Operator Tony, covered with sweat and excitement, was vociferously perplexed. He shrugged his shoulders. Everything was clear on top. There was no reason discernible for the disturbance. The slave at the foot had to clean up the mess and shovel a ton or two of char out of the pit.

John couldn't "figger it out" but he had some suspicions. The next time the elevator plugged he beat it promptly to the head and there spied Tony vigorously clearing the screen below the chute from the elevator which had plugged because of his neglect. Aha! John backed down while Tony was too busy to see him. The following week end John installed an overflow pipe in the chute arranged in such a manner as to discharge the char on the floor in case it could not get away at the bottom of the chute.

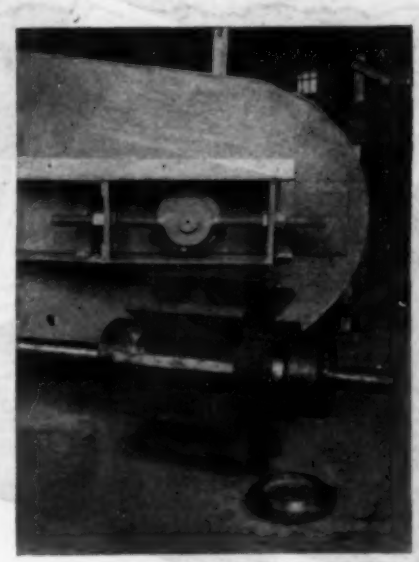
Tony did not sense the purpose nor the *modus operandi*, but he found out the next week when he had to clean up his own mess or suffer discharge. Tony now cleans the screens systematically and there have been no stoppages in the past ten years.

NEWT SMITH isn't satisfied with things just because they were created under the repute of the old chief. He sits on the job like a brooding hen. Eventually an improvement evolves and its simplicity elicits the wisenheimer's remark that "we should have done it long ago." To which the old man replies as usual. "How the — could we when we learned how only last week!"

Newt built a tray over the foot wheel of the char elevator mentioned above and there caught 75 lb. of char during an hour's run while the elevator hoisted 28 tons. This char rained down from above and was thereby subjected to abrasion and consequent loss. After Newt had finished hatching, the tray caught 4 lb.

This was accomplished by trial and error under which adjustments were mac'e in the diameter and speed of the head pulley and the location of the discharge. The crotch in the chute at the head had been too high to clear the trajectory of the bucket discharge and consequently there was a continual rain of char down the casing. When the rpm., as with a small head pulley, was too great the buckets threw the char against the ceiling. At the bottom Newt narrowed the delivery chute to 4 in. against a bucket width of 10 in. to reduce spilling and then he lowered the boot so that the feed trajected into the rising buckets instead of sliding down into the boot to be scraped up.

To further reduce attrition of char that falls between the belt and the foot pulley, the old flat wheel was replaced with a wing pulley as shown in the photograph. The wing pulley is cast with hubs long enough to extend through the sides of the boot and thus to offer a convenient housing for ball bearings out of dust. The pulley idles on the foot shaft which is fixed at its ends in a pair of eye bolts that serve as a rigid and practical take-up. This same device is standard for refined sugar elevators wherein it has the important additional quality of avoiding oil contamination with the product. The wing pulley is also useful on bulk sugar conveyors. In case sugar should accidentally reach the return belt, the winged foot pulley will throw it off without damage to the belt.



Wing pulley for foot of char elevator. Behind it lies boot of elevator with its eye-bolt take-up

ELEVATORS for sticky, lumpy raw sugar are advantageously equipped with a foot-shaft take-up arranged with a pair of arms like a hinged tuning fork to support the bearings. This device avoids the chattering and the wear of the ordinary take-up and it permits free movement against a spring in case a lump gets between the wheels and the chain. (The spring, not shown in the photograph, was placed between the lower nut and the support.)

Exactly the same arrangement can be used at the top in case it is desired to have the foot wheel in a fixed position. In this

Foot of raw sugar elevator. Springs and hinged arms permit movement of foot pulley

case the hinged arms are extended far enough back of the casing to support the motor and speed reducer. The fulcrum of the swinging arms can be located between the head shaft and the motor so as to balance the weight of the elevator buckets. One of our refined sugar elevators is thus equipped. There was no particular reason for it except that the Old Man said it was impracticable and we had to prove to him that he was wrong! However it keeps the boot free of accumulations and, since 1923 when it was built, not a nickel has been spent on it for repairs. For coal, rock, beets or any lumpy material, it is desirable to have the boot move with the take-up so that the buckets will just clear the bottom and have a smooth surface from which to pick up their load. The effect compares to pushing a shovel into a pile of rock as against entering it on a smooth plate under the pile. For such conditions the upper take-up offers a simple arrangement.

THE SAFETY OVERFLOW was installed on a refined sugar elevator about twenty years ago, just after we had suffered a particularly distressing shutdown with damaged salem buckets. For years nothing happened. Then one day the overnight bin (3,000,000 lb.) filled without notice. An avalanche of sugar at the rate of 80 tons per hr. suddenly catapulted onto the floor. This was a new experience for the operator who had been on the job only a few years. By the time he located John to get instructions, ten tons had piled up on the floor. This was less costly than a wreck of the elevator.

There are, by the way, a few men in every plant, i.e. very few, who are like the famous prototype of stupidity which after a generation of use as a pattern is still unexcelled. This subject, a railway station agent, wired the division superintendent: "Tiger escaped from cage. Now eating conductor. Wire instructions."

Elevator boots have always been set on the floor because in the stone age structural imagination could not contemplate a tensional hanger. A much better arrangement, standard in our house, is to suspend the elevator casing from the ceiling so as to have some space between the boot and the floor for quick and easy clean-out. Moreover there is a sanitary purpose in avoiding floor supports for any equipment that can hang from above.

STEAM JETS are provided on sugar house elevators that carry wet, soft or raw sugars that may occasionally cling to the inside of the buckets. These jets are arranged to blow upward into the mouth of the descending buckets so as to clear them of adhering material and leave a film of moisture as a lubricant for the free discharge of the next load. These jets are also useful for the week-end cleaning and for allaying dust. On one occasion when a repair man used a torch on the casing, the steam jet served as a fire extinguisher. In case repairmen are required to enter the casing, it is absolutely essential to take the precaution to disconnect the steam pipe. Steam and carbon monoxide can snuff out life almost as suddenly as a bullet.

There is one more device that is useful

Your toughest installation problems are solved by ARMSTRONG'S CONTRACT SERVICE FOR HEAT INSULATION

Nothing too complicated!

Modern generating stations are mazes of complicated piping and duct work. Whether it is for heat conservation or for the comfort and safety of employees, most of this work must be insulated.

But to insulate these jobs properly is not simple. For instance, metal ducts on the induced draft fan inlet and discharge to the stack shown here must have full freedom to expand and contract. Around them the insulation must be continuous, yet it must neither buckle nor crack open.

Armstrong's Contract Service supplied not only the right materials to solve these stack problems, but also the necessary construction knowledge. Armstrong's engineers determined the proper insulation application and Armstrong's mechanics installed the insulation, as well as the proper finish, evenly and neatly to the irregular surfaces.

You can get this skillful, dependable service through Armstrong offices in most of the nation's industrial centers.

CORRECT ANSWERS to the complex engineering questions that can arise on any heat insulation job are yours when you use Armstrong's Contract Service. You get the benefit of Armstrong's wide engineering experience. You also get materials of tested efficiency and trained skillful workmanship in application. Furthermore, this large, dependable organization takes full responsibility for every part of the planning, supervision, materials, and workmanship on your entire job. For complete details, write to Armstrong Cork Co., Building Materials Division, 3308 Concord Street, Lancaster, Penna.

ARMSTRONG'S INDUSTRIAL INSULATION

Complete Contract Service For All Temperatures

From 300° Below Zero

To 2600° Fahrenheit

on raw sugar elevators, namely a water lubricator on the chain and sprockets at the head. A small copper pipe is provided directly over each sprocket—there being two of these. This pipe delivers a few drops of water per minute to the top of the sprockets and chains. It prevents chattering of the chains and doubtless increases the life. In one case where the head shafts are located above the water tank, an exhaust steam supply is brought to the top where a small air-cooled copper coil is provided to produce distilled water.

AN ACTIVITY widely practiced without benefit of experience occasionally stands out because of its unique quality. Paradoxically, experience in this activity is no asset nor guarantee of success. It receives notice in the log because it affects the well-being of the crew. Typically:

Young Joe exhibited eagerness and enthusiasm in the research laboratory. Extracurricularly he strove for acquaintance with Chinese and Japanese hieroglyphs and he furthermore applied himself against the solution of certain human peculiarities. Particularly he noted that his cousin had made an unhappy selection of a spouse. As for him he proposed to exercise circumspection. He publicized his superior discretion in such matters and in fact he was currently analyzing a full size subject. The research proved more stubborn than he had anticipated and so he had been unable to reach a conclusion even after twelve months of effort. His final test was to be a surprise visit to the subject some morning while her hair was still down so that he could observe the housekeeping performance.

At this stage he matriculated in an evening school and there, right out of a clear sky, he met a new subject. Mathematic and logic were thrown out of the window and the wedding took place a few weeks later! Subsequently it was learned that immediately after his first meeting, Joe suggested to the young lady the filling of an application blank for a job in the refinery laboratory, and he offered to deliver it to the Boss. Thus he acquired the facts about her background.

DENNI, a skinny Cockney imported from the source, has been operating the evaporators since 1912. After the wife of his youth had passed away he annexed one of the bag salvaging department's powerful Katrinkas who one time bore allegiance to Emp. Francis Joseph. Her physical prowess compensated for her deficiency in the use of English. Denni apologized that he wanted to give the poor girl a break!

One night in December 1940 he failed to appear for his shift. Frantic calls came from relatives. It was rumored that his $17,000 nest egg had gravitated to the control of Katrinka. After his first wife died, he philosophized that it was unwise for an aged man to remarry and especially so to a young woman. Later he concluded that his case was the single exception. He was 68. His disappearance, mentioned above, was due to a street accident that landed him in Temple Hospital with a broken rib. He had considered it unimportant to use the telephone.

NAMES IN THE NEWS

W. E. Hanford

William E. Hanford, manager of the central research laboratory of General Aniline and Film Corp. at Easton, Pa., has been named director of research.

Clark O. Miller has been advanced to the position of professor of chemical engineering at Case School of Applied Science.

Thomas P. Brown has been promoted to the position of vice president in charge of the Chemical Color Division of Reichhold Chemicals, Inc., Brooklyn, N. Y.

A. A. Shimer, assistant to the director of operations of Hercules Powder Co.'s Naval Stores Department, has retired.

Paul F. Derr has joined the staff of Westvaco Chlorine Products Corp. in South Charleston, W. Va., as research chemist.

E. C. Williams has resigned as vice president and director of General Aniline and Film Corp. He will continue as consultant to the president in technical and development matters.

Lauchlin M. Currie has been elected vice president in charge of research of National Carbon Co.

Laurance S. Reid, formerly assistant chief engineer for the Southern Natural Gas Co., has been appointed professor of chemical engineering at the College of Engineering, University of Oklahoma.

Cornelia T. Snell, of Foster D. Snell, Inc., has been appointed chairman of the New York Section of the American Chemical Society to succeed **Ross A. Baker** who has resigned.

Thomas H. Vaughn has been named director of research of the Wyandotte Chemicals Corp. Dr. Vaughn replaces **Howard F. Roderick** who has been transferred to special assignments with the sales department of the Michigan Alkali Division of Wyandotte Chemicals.

Harris & Ewing

R. L. Copson

Raymond L. Copson, formerly chief of chemical research and engineering for the Tennessee Valley Authority at Muscle Shoals has been appointed director of research for Rumford Chemical Works.

Benjamin S. Garvey, Jr., has been appointed technical service manager on rubber chemicals of the B. F. Goodrich Chemical Co.

David J. Guy has been named manager of the Natural Resources Department of the Chamber of Commerce of the United States to succeed **Walter DuB. Brookings,** who has retired to an advisory position.

James L. Naylor has been appointed assistant manager of the Dyestuff Department, Calco Chemical Division, American Cyanamid Co., Bound Brook, N. J.

L. D. Granger and **A. G. Bussmann** have been elected vice presidents of the Wickwire Spencer Metallurgical Corp.

H. L. Dixon has been appointed production manager of the Industrial Products division of the B. F. Goodrich Co. Mr. Dixon is a graduate chemical engineer from Simmons University and has been with Goodrich since 1934.

Fred W. Cox, Jr., has joined the research staff of Southern Research Institute, Birmingham, Ala. Dr. Cox was formerly with the Goodyear Tire and Rubber Co.

Allan B. Clow has been appointed to the newly created position of executive vice president and general manager of Gallowhur Chemical Corp.

Gordon A. Kessler, who holds a degree in industrial chemistry from the University of Maryland and an L.L.B. from New York University, has been named attorney in the Patent Division of the Houdry Process Corp. Prior to joining Houdry, he was patent attorney for the Texas Co. for several years.

J. E. Ohlson

John E. Ohlson, formerly with Wyeth, Inc., Philadelphia, has been appointed senior chemical engineer of the Pennsylvania Salt Manufacturing Co., Philadelphia.

W. J. O'Brien, vice president in charge of manufacturing, has been named chairman of the research and manufacturing committee of the Glidden Co. He assumes administrative charge of the chemical and pigment division.

J. N. Taylor is retiring from the position of acting chief of the chemicals unit of the Bureau of Foreign and Domestic Commerce after 37 years in the government service, 17 of them in this bureau.

C. E. Inman, formerly with the Hooker Electrochemical Co. has joined the research and development staff of Penn Salt Manufacturing Co. of Philadelphia. Other recent additions to the research and development staff at Penn Salt include: **H. S. Fisher, O. T. Aepli** and **E. P. Street.**

Frank M. Biffen has been appointed chief of the chemical service section, Johns-Manville Research Laboratory, Manville, N. J. Prior to his present association, he was director of the analytical laboratories of Foster D. Snell, Inc.

Henry A. Gardner has retired from active duty as director of the Scientific Section of the National Paint, Varnish and Lacquer Association, after an association with the paint industry that has been continuous for 38 years. **George G. Sward,** who for 20 years has been closely associated with Dr. Gardner in the Scientific Section, has been appointed assistant director to take over the responsibilities until the position is filled.

L. B. Arnold, Jr. has joined the staff of Arthur D. Little, Inc., Cambridge, Mass. Dr. Arnold was previously in the Organic Chemicals and Rayon Department of E. I. du Pont de Nemours & Co. and more

recently an assistant director of the Chemistry Division of the Metallurgical Laboratory at Chicago, Ill.

Wendell P. Metzner has been transferred by Monsanto Chemical Co. from the St. Louis Laboratories to the Central Research Laboratories at Dayton, Ohio, where he will head the flexible type high polymer group. He will be succeeded as a group leader in the Organic Chemicals Division research laboratories by **Harold L. Hubbard**, a graduate of Alabama Polytechnic Institute, who has been with Monsanto as research chemist for ten years.

Mary Worsham

Mary C. Worsham, first woman chemical engineer in the entire Sterling Drug Inc. organization, has joined the Frederick Stearns & Co. Division, Detroit, where she is on the factory manager's staff assisting in plant layout and development. Miss Worsham is a graduate of the University of Michigan and a member of Tau Beta Pi and Sigma Xi.

Alfred G. Rossow has been transferred from the Dayton Research Laboratories of Monsanto Chemical Co. to the St. Louis research laboratories. Dr. Rossow was formerly employed in Monsanto's Plastics Division, Springfield, Mass., and was transferred to Dayton two years ago.

E. T. Frankenhoff, vice president of Dicalite Co., Los Angeles, has moved his headquarters from Chicago to Los Angeles. **A. G. Frankenhoff** has now become vice president and general manager of the company.

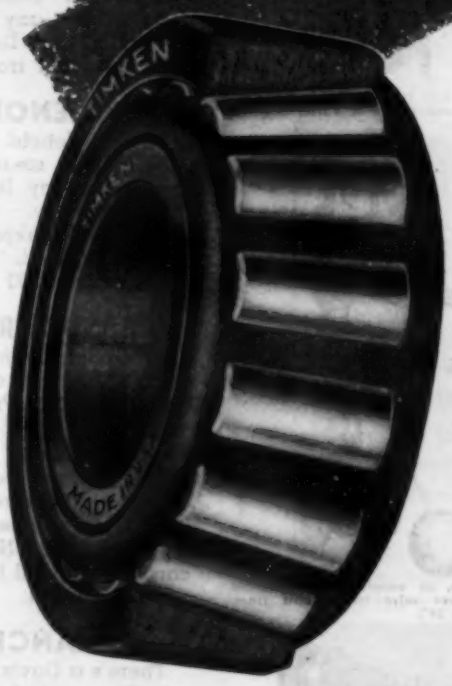
M. L. Arnold, engineer with the Richfield Oil Corp., Los Angeles, was elected president of the California Natural Gasoline Association at its recent annual meeting.

K. E. Kingman, for the past 5 years superintendent of the Oleum refinery of Union Oil Co. of California and superintendent of operations, has recently been appointed manager of the company's refinery at Wilmington, Calif.

Hosmer W. Stone, associate professor of chemistry, University of California, Berkeley, has been selected as a civilian education specialist by the War Depart-

Timken Bearings

meet all chemical plant requirements



The elimination of friction and wear; the ability to carry radial, thrust and combined loads; and the holding of moving parts in constant alignment; are just as important in chemical plant equipment as they are in industrial machinery of every kind. Timken Tapered Roller Bearings provide all these necessary qualities.

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TAPERED ROLLER BEARINGS

THE TIMKEN ROLLER BEARING COMPANY, CANTON 6, OHIO

ment to teach in university study centers for troops in the European theatre. The first center, scheduled to open at Shrivenham, England, will have an enrollment of about 4,000 and will offer a wide variety of courses patterned on the average American university 8-week summer session.

T. L. Gresham has been named director of organic chemicals research of the B. F. Goodrich Co. Dr. Gresham has been director of Koroseal and plastic research since 1943.

C. E. Graves has been appointed manager of the Grasselli Chemicals Department office of the DuPont Co. in Tacoma, Wash.

C. F. Gibbs has been appointed director of polymerization research for the B. F. Goodrich Co. Dr. Gibbs joined Goodrich in 1936.

John E. Ford, Jr. has been named an executive assistant of the Houdry Process Corp. Mr. Ford joins Houdry after eight years' experience with the M. W. Kellogg Co.

C. G. Gerhold has been named manager of the Riverside research and development laboratories of the Universal Oil Products Co. **R. B. Day,** manager of laboratories for the past seven years, has been relieved of his duties at his own request.

Ralph E. Montonna, professor of chemical engineering at the University of Minnesota, has been made assistant dean of the Graduate School. Dr. Montonna will retain his academic status as professor of chemical engineering and will continue to act as director of the Minnesota Institute of Research.

Raymond J. F. Kunz has joined the Special Products Division of the Borden Co. as chemical engineer. Dr. Kunz will act as consultant and advisor in engineering development and construction of plants operated by the division.

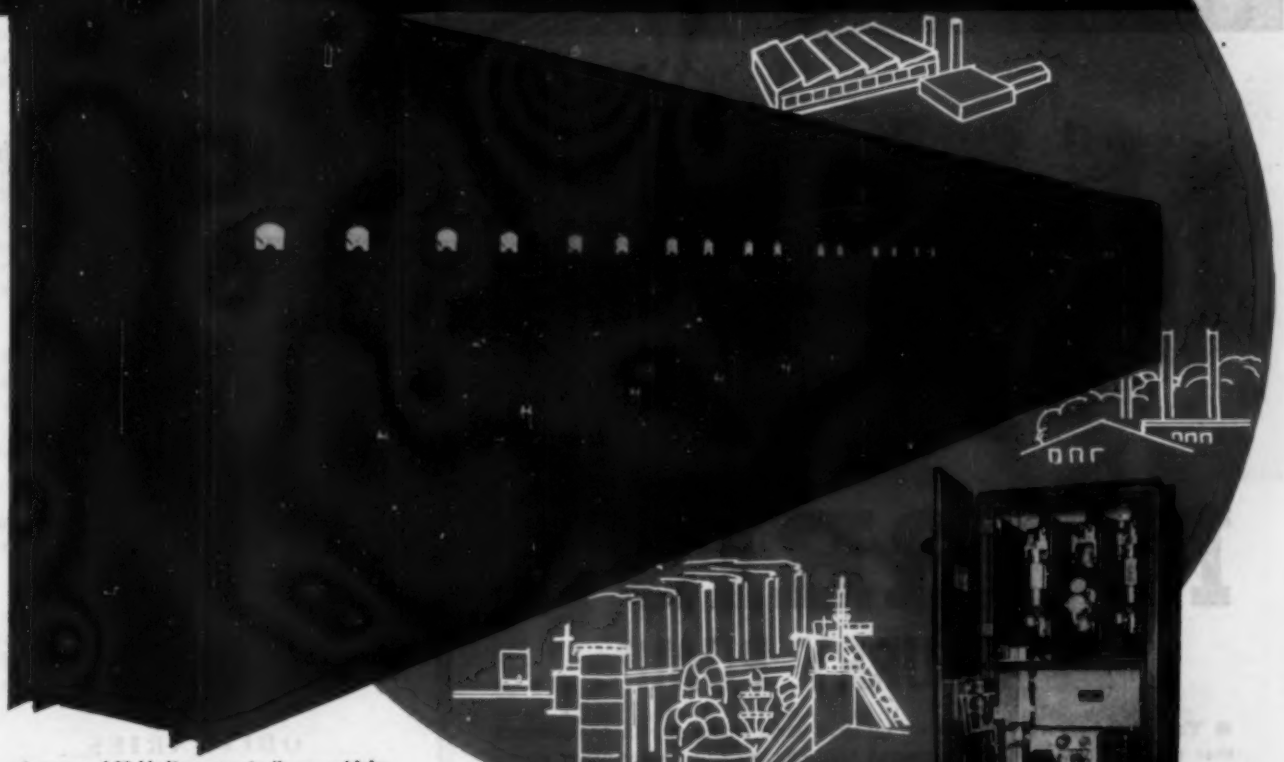
Berton H. DeLong and **Paul B. Greenawald** have been appointed directors and vice presidents of the Carpenter Steel Co., Reading, Pa. In his new post, Mr. DeLong will continue to supervise the research and development work of the company and Mr. Greenawald will be in full charge of mill production.

L. W. Kuechler, a graduate of Drexel Institute of Technology in chemical engineering, has joined the pilot plant group of The Barrett Division, Allied Chemical & Dye Corp. Another recent addition to the pilot plant group is **D. R. Ormanowski,** formerly of the Celanese Corp. of America.

Emma E. Crandal, head of the library of the Universal Oil Products Co., is retiring after 20 years of service.

F. S. Carpenter, formerly factory manager of the Los Angeles synthetic rubber plant, operated for the Government by United States Rubber Co., is being transferred to the company's plantation division with

2300-VOLT PACKAGED CONTROL FOR SURE, SHORT-CIRCUIT PROTECTION



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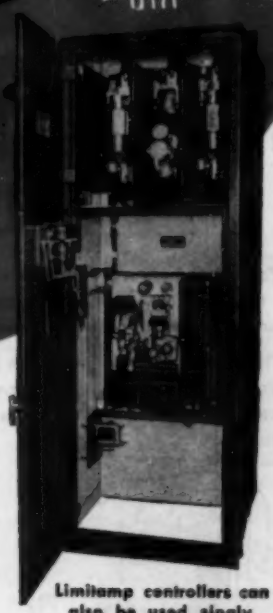


Limitamp controllers can also be used singly.

½-cycle Operation Means Safety

Limitamp control will stop high-voltage fault currents in one-quarter cycle, and clear them in less than one-half cycle—reducing the effect of the short circuit on your motor or control.

Other Advantages, Too

Bulletin GEA-4247 will tell you all about them—how Limitamp control affords safety for men and machines, how it can be furnished as single units, and how it comes in different enclosures for different operating conditions. For a copy, contact your local G-E office or write directly to General Electric Co., Schenectady 5, N. Y.

BUY WAR BONDS

GENERAL ELECTRIC

INDUSTRIAL CONTROL

headquarters in New York. He will be succeeded at the Los Angeles synthetic rubber plant by **Philip E. Rice**, formerly factory manager of the Naugatuck, Conn., chemical plant. Mr. Rice will be succeeded by **Donald L. McCollum**, who has been production manager.

Alfred Hall of the chemical research branch, U. S. Forest Service, has been transferred from Washington, D.C., to Portland, Ore., where he is Pacific Northwest field director in charge of wood waste products research.

Kenneth A. Smith, engineer, and **Alexis Pantaleoni**, business manager of Electronic Chemical Engineering Co., Los Angeles, have left for a two-month trip to South America in connection with application of recent electronic-chemical developments to certain industries on that continent.

Miriam Lauren has joined Foster D. Snell, Inc., where she will have charge of an enlarged micro-analytical laboratory. **Gerald M. Compeau**, formerly with Colgate-Palmolive-Peet Co., has been appointed assistant to the director.

V. R. Damerell has been promoted from assistant to associate professor of chemistry at Western Reserve University.

S. Pellerano, formerly plastics research engineer for Kaydon Engineering Corp., is now technical supervisor and research chemist with the Richard Alan Button Co.

OBITUARIES

Arthur E. Huff was killed in the Pacific Dec. 15, 1944. Before the war Captain Huff was a research chemist in the laboratories of the Monsanto Organic Chemicals Division, St. Louis.

Frederick C. Renner, 44 general manager of sales of Monsanto Chemical Co.'s organic chemicals division, died of heart disease in St. Louis June 26.

C. Austin Buck, 78, a director of Bethlehem Steel Corp. and formerly a vice president, died in Bethlehem, Pa., July 13.

Roscoe G. Dickinson, 51, professor of physical chemistry at the California Institute of Technology and acting dean of the Institute's Graduate School of Chemistry, died in Pasadena July 13.

Zack Phelps, 58, assistant general manager of the Pigments Department of E. I. du Pont de Nemours & Co. died suddenly July 15.

George W. Raiziss, 60, a director of Abbott Laboratories, died July 16.

W. P. McCready, 44, general superintendent at the plant of Mathieson Alkali Works, Saltville, Va., died on July 18.

Augustus H. Fiske, 65, retired chief chemist of Rumford Chemical Works, died in Massachusetts July 28.

INDUSTRIAL NOTES

Western Rosin & Turpentine Corp., Detroit, has changed its name to the Western Solvents & Chemical Co. Management and location of the company are unchanged.

The Paraffine Companies, Inc., San Francisco, has announced that Lester M. Clayberger who has been with the armed forces, has resumed his post as advertising manager of the paints and building materials division of the company.

Moore Dry Dock Co., Oakland, Calif., has appointed B. M. Pilhashy, San Francisco, to represent it in the construction and sale of a new line of rotary dryers, boilers, tanks and general steel equipment. His headquarters are in the Merchants Exchange Bldg.

The American District Steam Co., North Tonawanda, N. Y., is now represented in the Cincinnati area by the Engineering Equipment Co. and in the St. Louis territory by the Weeks Engineering Co.

Heyden Chemicals Corp., New York, has added E. W. Biggs to its general sales staff. Mr. Biggs will represent the company in Pennsylvania and western New York.

France Packing Co., Philadelphia, announces a change in management. E. A. France, son of Adam Warren France who patented the metallic packing and founded the business nearly 50 years ago, is now president and general manager. J. C. Allen is the new treasurer.

Joshua Hendy Iron Works, Sunnyvale, Calif., has named James L. Ray to head the company's gas and steam-turbine engineering department in San Francisco and to supervise the enlargement of its technical staff.

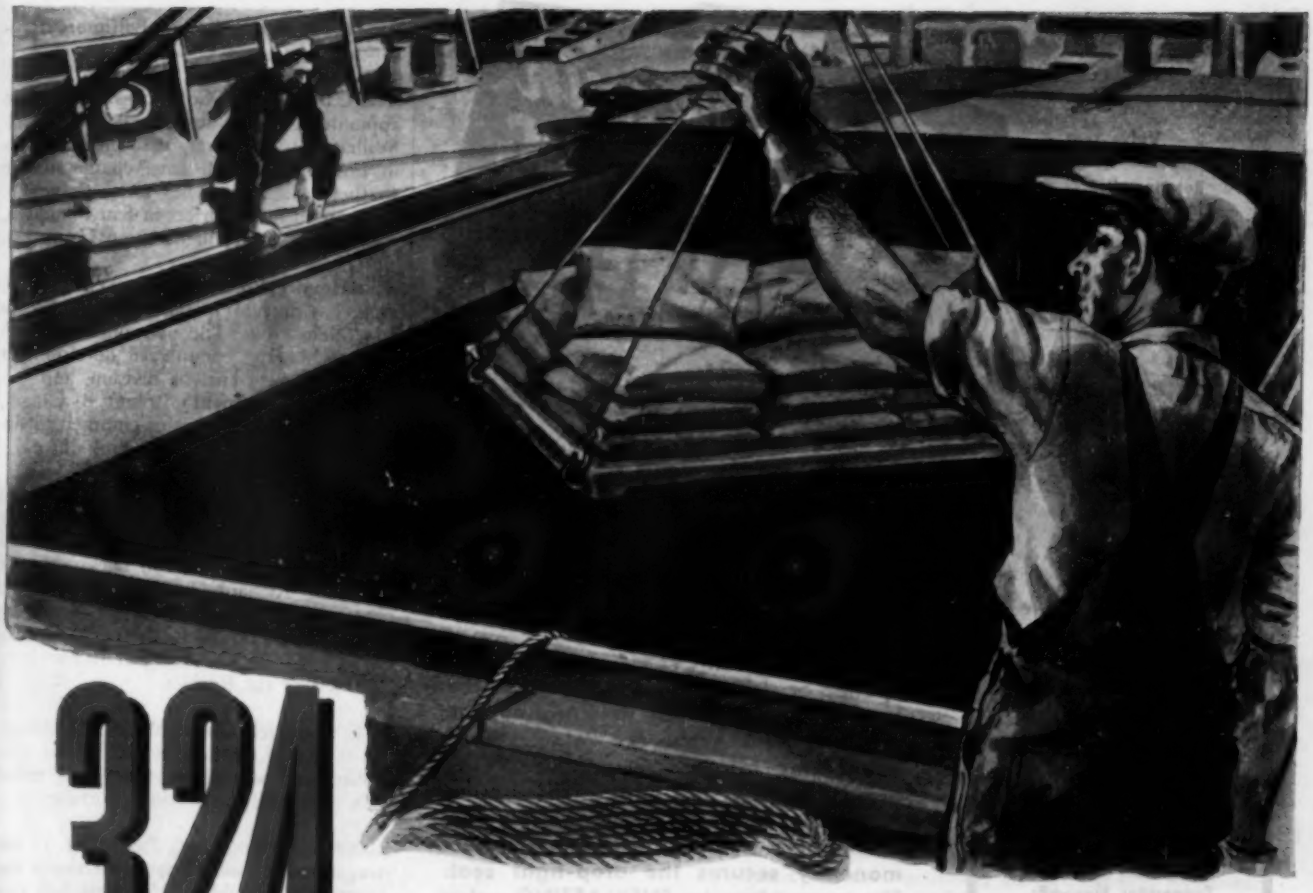
Wilson Welder and Metals Co., New York, has appointed the Graybar Electric Co. exclusive distributors of its electrodes in the areas served by Graybar's Cincinnati, Pittsburgh, and Cleveland offices.

Monsanto Chemical Co., St. Louis, will construct a $450,000 unit for the production of Santocel at its Merrimac division plant outside of Boston.

Godfrey L. Cabot, Inc., Boston, is now represented in New England by the Raw Materials Co., Boston. This company was formed by C. W. Bloom, former general sales manager for Cabot.

Ansul Chemical Co., Marinette, Wis., is erecting a new unit at its plant to house manufacturing operations for Dugas fire extinguishers.

The Wm. Powell Co., Cincinnati, has placed Allen B. Stiles in charge of sales



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These sturdy containers are daily proving their efficiency and economy under the rigorous conditions of wartime shipping. Husky, moisture-resistant Multiwalls protect products from dampness, salt spray, and even rain. And, Multiwalls reduce siftage losses as well as losses caused by infestation and contamination.

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for the Philadelphia and Baltimore territories.

The Carborundum Co., Niagara Falls, has appointed two new district sales managers. William H. Homeyer, with headquarters in Los Angeles, will have charge of the southern California sales area. Francis J. Blake, with headquarters in San Francisco, will supervise sales in northern California.

The Houdry Process Corp., Wilmington, Del., has opened an office at 115 Broadway, New York. The new office is headquarters for the commercial development division, project analysis division, and foreign sales department. Robert B. Cragin, vice president in charge of commercial development, directs the New York office.

Ethyl Corp., New York, will operate on the basis of four principal marketing areas known as eastern, central, southern, and western and has appointed sales managers for each. Richard C. Murphy will have charge in the eastern, James E. Boudreau in the central, Harold R. Berg in the southern, and Sanford M. Wagner in the territory west of the Rockies.

B. F. Goodrich Chemical Co., Cleveland, has organized a new division for the promotion and sale of thermo-setting resins with Sam L. Brous serving as manager.

Robins Conveyors, Inc., Passaic, N. J., has reorganized its sales department under the direction of Harold Von Thaden, first vice president. E. C. Salzman is now in charge of foreign operations with offices at 70 Pine St., New York. J. F. Meissner has been moved from Chicago to Passaic to direct engineering sales. The equipment sales section is now under A. E. Conover and T. W. Matchett has been put in charge of sales research and training.

Borne Scrymser Co., Elizabeth, N. J., and Charlotte, N. C., has promoted Russell C. Young to the position of southern sales manager.

The Baldwin Locomotive Works, Philadelphia, will open headquarters in Paris, France, in September to handle foreign sales of its heavy machinery. Thomas Butts will be in charge of the office.

The Colorado Fuel and Iron Corp., Denver, Colo., has advanced K. B. Stuart to the position of manager of sales for the chemical division.

National Engineering Co., Chicago, has appointed Bullock-Smith Associates, 136 Liberty St., New York, as sales representatives in the metropolitan area.

John W. Boyer, Washington, industrial consultant, has moved his office to 1627 Eye St., N. W.

Reliance Electric & Engineering Co., Cleveland, announces that the Standard Electric Motor Works will supplement the activity of the company's district office in Detroit and the C. & G. sales and Engineering Co. will act in a similar capacity in Milwaukee.

CONVENTION PAPER ABSTRACTS

CONTENTS

SUGGESTIONS FOR ALUMINUM PLANT DISPOSAL

WARTIME expansion of the aluminum industry has been so vast that most of the industry is less than three years old. We are considering therefore, for all practical purposes, a very young, almost a new, industry. And yet, the big aluminum producers throughout the world are old companies. In this country 91 percent of the ingot, 96 percent of the alumina, and over 75 percent of the heavy fabricating capacity are under the management of a company which has been producing aluminum here for 57 years. There is room and a need for new and younger corporate blood. New outlets must be found and old ones greatly expanded if many of the plants, especially in the West, are to contribute to postwar prosperity. A pioneering job has to be done. Since the West has specialized for almost a century in that kind of hard work, western interest in light metals is the hope of the industry. Now, as never before, there is a chance for aluminum to come into its own as a commercial metal.

Privately-owned capacity in this country amounts to slightly over a billion pounds, about the same as that in Canada. The private industry is therefore three times as large as it was before the war.

The DPC capacity statistics are steadily becoming less meaningful. Some of the facilities never were used at all. During the past year many of the facilities have been shut down. The peak of aulminum production occurred in 1943 when 1.8 billion pounds were produced. Last year only 1.5 billion pounds were turned out and although there was a spurt in production early this year, the year's total will probably drop below that of 1944.

This rapid development is both an accomplishment and a headache. You cannot blithely assume that the western aluminum industry is as strong as it is big; that because it is here in plants and facilities it is here to stay. There is much to do before it is really a permanent part of the West.

A fully integrated industry—from the raw material to the final market—is, of course, the ideal pattern. Western fabricating facilities have been expanded during the war, but not on a scale commensurate with the growth of ingot capacity. Another deficiency on the fabricating side is the lack of diversification. No big hammer forging plants are available west of Indiana. Neither are there any mills for

rolling large-sized rod and bar, needed for the big forgings. The West is long on ingot capacity and short on all other facilities because the aluminum industry, both the public and privately financed, came here to use cheap and abundant power.

Many specific lines of action must be pursued promptly if your aluminum facilities are to do business after the war on the soundest possible basis. Community initiative and local capital are the healthiest and most reliable source of the necessary new competition. DPC plants offer the quickest means for getting independents started in the Western aluminum industry and for making the industry generally more competitive. And now is the best time.

Emphasis on community action is no appeal to sectionalism. Development of the western aluminum industry will help producers and consumers of aluminum everywhere. It will also lessen the gap, industrially, between the West and other parts of the country. Success in building up the light metals industry will be another bond, as are the railroads, vast power systems and other industries, between the West and the East.

Irving Lipkowitz, Department of Justice, before Light Metals Conference of the Western States Council, Seattle, June 21, 1945.

CALIFORNIA'S MINERALS AND THE CHEMICAL INDUSTRIES

An interesting and outstanding feature of California's mineral resources is their remarkable diversity. The state produces on a commercial scale annually around 60 different mineral substances, both metallic and non-metallic. Of some of these substances, particularly some that are important raw material sources for various chemical processes and products, California has adequate, even abundant, resources.

Principal minerals required by the chemical processing industries are sulphur and pyrite, salt, chemical lime and limestone, fluorspar, barite and boron minerals. Sodium carbonate, sodium sulphate and calcium-magnesium chloride are also important chemical raw materials, but by far the larger part of these salts consumed are products of other chemical industries, chiefly those using sodium chloride as raw material.

The statement relative to salt and sodium salts is not the case in California. During 1944, California produced the largest annual output of sodium salts, including soda ash, trona, and salt cake ever reported for the state, with some 300,000 tons being shipped as compared to 260,000 tons in 1943. Output of borate minerals last year amounted to 276,000 tons, while production of salt rose to 770,000 tons, largest annual yield ever reported for the state. As to reserves, output of sodium chloride is limited only by the capacity of plants that may be built to crystallize it from sea water or from saline desert lakes.

Lime is one of the most important chemical raw materials. In 1942 the structural use had decreased to such a point and other uses increased to where they required the largest part of the lime burnt in this state. Industrial limestone was shipped from 19 properties

in 11 counties during 1943 and totalled 495,262 net tons, valued at $1,378,647, increases in both tonnage and value over the 1942 figures.

Principal uses of fluorspar are in open-hearth steel manufacture and for making hydrofluoric acid and fluorine chemicals. Several occurrences of fluorspar have been noted in California, but only a small amount has thus far been mined.

Barite has a variety of uses. Its barium content makes it useful in the chemical and glass industries. It is also used in the paint, lithopone, and paper industries, and its high specific gravity gives it value as an oil-well drilling mud. Barite production in California has ranged between 20,000 tons and 33,000 tons per year from 1935 to 1943.

California today is the major world source of borax, supplying more than 90 percent of the world's needs. Plants at Searles Lake and at Kramer produced in 1943 a total of 216,687 tons of equivalent 40 percent A. B. A. in borate materials, valued at nearly $5 million. The potash operations at Searles Lake are combined with those for extracting borax and soda (carbonate and sulphate), bromine and lithium. Tungsten will also be recovered, according to some reports.

Walter W. Bradley, State Mineralogist for California, before the American Institute of Chemical Engineers, Northern California Chapter, San Francisco, Calif., July 24, 1945.

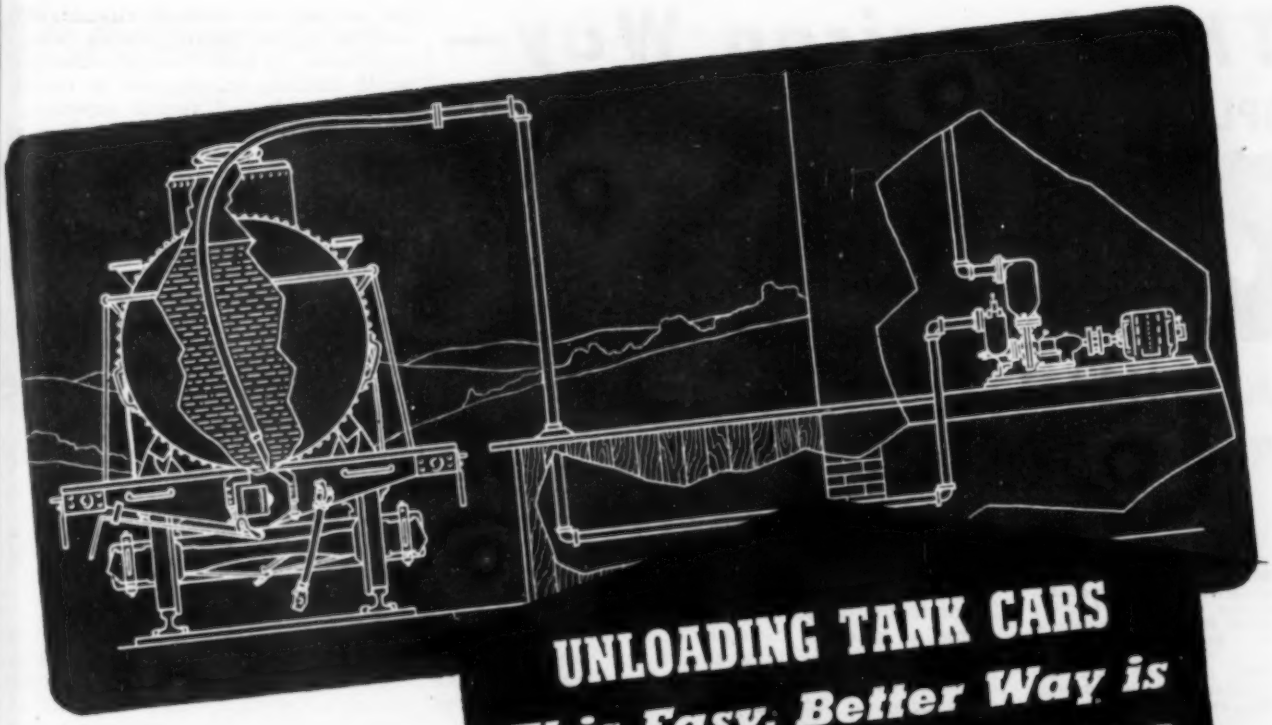
JOB EVALUATION DURING AND AFTER RECONVERSION

Job evaluation, the science of measuring the relative importance of jobs in industry, must play an essential role in solving the problem of postwar industrial adjustments. With the reconversion of industry to peacetime production it will be necessary for industry to re-evaluate jobs to determine whether one is worth more or less than another. It may even be necessary to re-appraise the job of a worker who will produce the same tools and handle the same machine in peacetime as he did during the war.

Job evaluation does not fix absolute wage rates, except when the general wage level for the occupation has already been set elsewhere. Usually each job is evaluated according to: skills, knowledge and experience necessary for the job; relative importance of each factor to the job as a whole; and relative importance of the job as a whole, in relation to other jobs.

Labor's continued support toward the practice of job evaluation needs to be held, particularly at a time when such evaluation might result in a lower occupational rating for some jobs, calling for a corresponding reduction in the wage rate.

During the war both labor and management have shown a favorable attitude toward job evaluation. Its increased use in recent years has taken place at a time when the wage level was almost continuously going up. This contributed to its ready acceptance by workers, who associated it with wage increases. Also, since the start of wage stabilization, both employees and employers have used job evaluation as one of the few procedures acceptable for justification of upward wage adjustments. However, it is an open ques-



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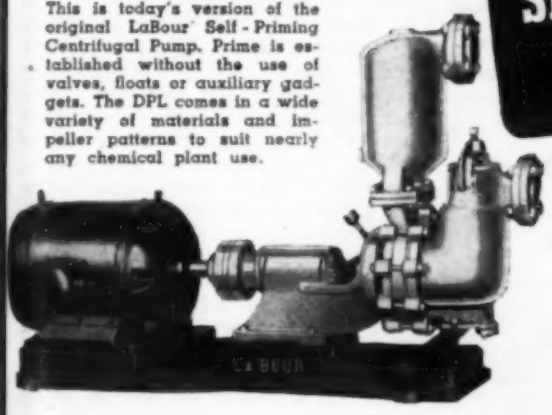
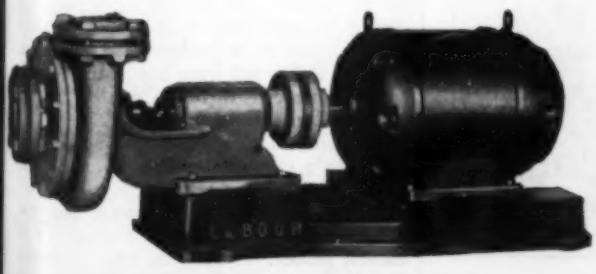


TYPE Q

Although not self-priming, this compact unit will not air-bind. Design eliminates needless churning, hence makes it practical to pump liquids of higher viscosities than can be economically handled by ordinary centrifugal pumps.



Moving corrosive or dangerous liquids from tank car to plant is a made-to-order job for LaBour Self-Priming Centrifugal Pumps, which lift liquids by suction.

With LaBour Self-Priming Centrifugal Pumps, cars are emptied through manholes without pressure on the tanks. The line between car and pump is under suction—liquid cannot leak out. This removes a serious hazard to car, roadbed, unloading platforms and personnel.

Since LaBour pumps attain efficiencies not usually associated with this open impeller type pump, they do the unloading job quickly and at low cost. Maintenance requirements are few, another factor in economical operation.

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tion whether this favorable attitude will continue in the face of possibly falling wage levels. In such a case job evaluation would certainly be subjected to critical scrutiny far beyond current experience. The readiness of labor to accept it as a legitimate basis for such downward rate adjustment is yet to be generally proven —and the real test of the soundness and solidity of any job evaluation will be made when those downward adjustments have to be made. To insure the success of job evaluation programs active labor participation must be secured

Establishment of proper wage differentials among the various jobs in a plan is one of the most important requisites of sound industrial relations. Under present conditions it is unwise to try to force down workers' throats a job evaluation schedule that they have not helped to make.

Willis M. Fanning, vice president, Albert Ramond and Associates, before Pawtucket Business Men's Association, Pawtucket, R. I., May 28, 1945.

SYNTHETIC RUBBER COSTS

In a period of about 2½ years and at a cost of $750,000,000, a synthetic rubber industry was built which is capable of producing over 1,100,000 long tons of rubber polymer per year. This is 60 percent more than was ever consumed by the prewar rubber industry.

At the present time the synthetic polymers available can replace natural rubber for about 75 percent of the tonnage to give products of satisfactory or superior quality. Another 15 percent of the tonnage can be replaced to give products of usable but inferior quality. The remaining 10 percent of the products require natural rubber. Real improvements are being made and within five years synthetic rubber will probably be the equal of natural rubber in all uses.

Sufficient experience has been obtained to make a preliminary cost comparison. Rubbers such as neoprene and buna-N were being used prewar due to the fact that their special properties made them superior to natural rubber in certain products. Their postwar use will be greatly increased due to the lower costs of production as a result of large scale operation. However, it does not appear that either one of them in their present form will become a large general purpose rubber such as is used for tire production.

Butyl rubber will also be used for certain special purpose products. Recent operating results indicate that butyl rubber could be produced and sold at a profit for 15 to 18 c. per lb. At these prices it should be extensively used in the production of inner tubes because of its superior quality. It has not been adequately evaluated for tire construction although it may offer real possibilities along these lines. The use of these synthetics should correspond to a consumption of approximately 100,000 long tons a year.

Buna-S is the main general purpose rubber and will be the chief competitor of natural rubber. It does not seem probable that this competition will become serious for a period of several years. Even after the rubber-producing areas are recaptured there will be a period of almost a year before they can be brought back into

reasonable operation. In addition, for a period of several years the world will probably be able to consume all the synthetics and natural rubber available to meet the very large deferred demands. Therefore, it seems most likely that the real competition will develop in the early 1950's. At the present time the quality of buna-S is not equal to natural rubber for a number of large tonnage uses. This difference in quality will be reduced or re-reversed by improvements in the synthetic, and it seems reasonable to assume that by 1950 it should be of at least equal quality. The competition will therefore be largely based on cost considerations. The largest factor in the cost of producing buna-S is the cost of butadiene. From petroleum butylenes it is possible to produce butadiene for an out-of-pocket cost of about 8 c. per lb. with the present price of butylene. This cost does not include any provision for amortization, sales expense, profit, or interest on investment. Postwar, with lower prices for butylene, it might be possible to make butadiene for 6½ c. per lb.

The butadiene-from-alcohol process has been extremely successful, and it has been the major producer so far during the emergency. The plants are of simple construction, and the operating costs are very low. However, even with alcohol at 15 c. a gal. the out-of-pocket cost of butadiene is several cents a pound more than from butylene. It has been hoped by many that the synthetic rubber industry might be an outlet for agricultural products giving us "home-grown" rubber. It will be impossible to produce alcohol for 15 c. a gal. from corn or wheat unless the farmers are willing to accept a low price per bushel for the grain. The prices of grain which were supported by the government before the war would make butadiene cost about 15 c. per lb. Such a price for butadiene would make it difficult for synthetic rubber to compete with natural rubber on a cost basis. At the present time the alcohol cost to the plants is over 90 c. per gal., making the butadiene out-of-pocket cost over 40 c. per lb.

With butadiene from 6½ to 8 c. per lb. as could be produced in the petroleum plants, the out-of-pocket cost of buna-S should not be over 11 c. and it should be possible to sell it at 15 c. and receive an adequate profit and return on investment. The capacity of these low cost butadiene plants should be sufficient to allow the production of 400,000 to 500,000 long tons of buna-S per year.

E. R. Gilliland, OSRD, accepting Leo Hendrik Baekeland Award of North Jersey Section, American Chemical Society, Newark, May 14, 1945.

SURPLUS PROPERTY DISPOSAL

It is the responsibility of the Office of Surplus Property of the Department of Commerce to dispose, in a manner consistent with the intent of Congress, as expressed in the Surplus Property Act, of unknown quantities of almost unlimited types of consumer goods in unknown condition declared to us as surplus by owning agencies, principally the military services, at unpredictable times in presently unspecified places. Estimates of the volume of consumer goods which will avoid war

destruction and be declared surplus at various times in the future range from 5 to 15 billions of dollars.

After goods have been declared, they are inspected by us to assure their location, quantity, condition, and to provide as adequate and complete a description as possible so we can tell prospective buyers as accurately as we can what we have to sell. Our usual medium of advising prospective buyers of what we have for sale is the *Surplus Reporter*. The *Reporter* gives a brief description of thousands of miscellaneous items. The *Reporter* is sent to every dealer in the trade who makes his interest known to us. Any dealer who desires to purchase an article listed in the *Reporter*, or who wants further information, writes to one of our regional offices. The regional office then forwards a form which contains as complete a description of the property as we have, lot size, the location of the property, when it may be inspected, its condition, the date and hour when bids will be opened, the conditions of sale, and other pertinent information. This form is itself a bid form but so simplified that all the bidder need do is to sign it, check the type of business in which he is engaged and state how much he will pay for a specified amount of the goods. This type of sealed bid selling is followed in most cases since it insures equality of treatment. For all practical purposes, it may be said we have abandoned the informal bid and negotiated sale methods.

Construction equipment, farm machinery, and automotive vehicles are sold by the Spot Sale Method. Equipment of this nature is in such critical short supply that it is sold as promptly as possible at regularly conducted sales at the places where the property is located. Notice of such sales is widely distributed to dealers in the various types of equipment. Ceiling prices are established by OPA both for sale by us and resale by the dealer.

Spot Sales are sales made at the property location. Bidders submit written bids for each item, the bids are immediately collected, the highest bid determined, and the award made. Contracts are signed and full payment made on the spot.

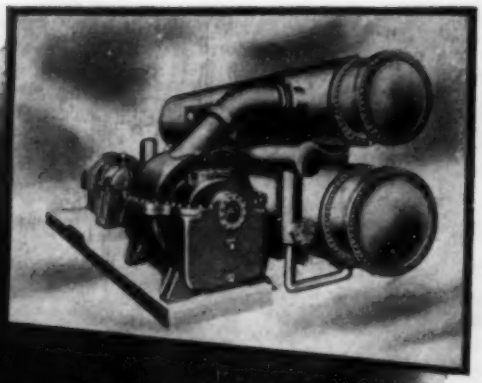
Synchronized Spot Sales are made according to a predetermined program calling for regular spot sales within the same region on the same day of each and every month.

In disposals to commercial buyers, frequently the major problems center on the choice of the level of trade to which the property is to be offered and the standards to be employed in classifying prospective purchasers as belonging to one or another of the several levels of trade. Clearly, direct sales to consumers would not achieve the wide and equitable distribution contemplated by the Surplus Property Act.

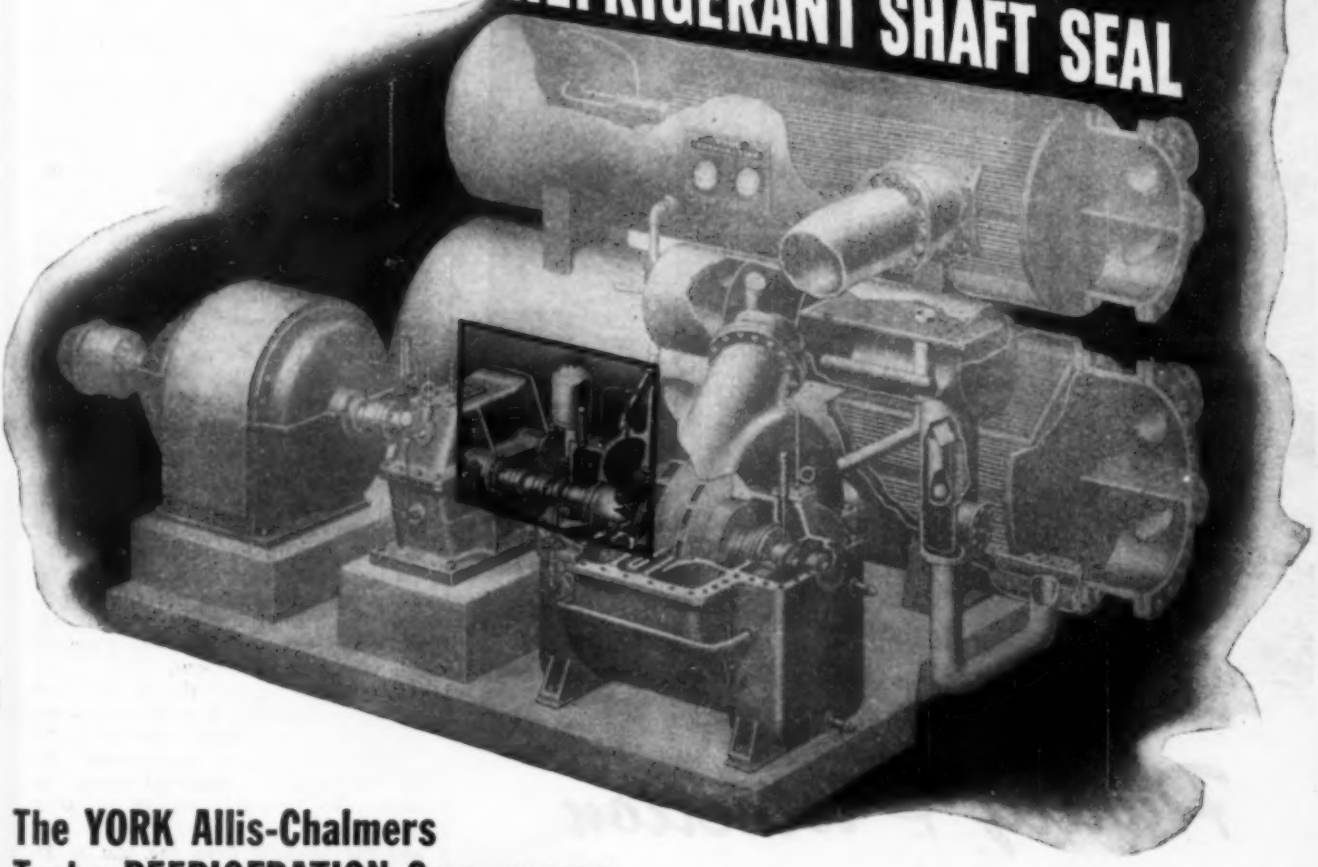
Despite the comparative ease, from an administrative viewpoint, of selling goods back to the original producers, sales to such outlets are not generally engaged in, except when after careful scrutiny it appears that the national interest and the objectives of the Act will best be served by so doing.

On the basis of our experience in disposing of property, it would seem that most of the consumer goods will probably

To Prevent Gas Leakage



Accurately Finished REFRIGERANT SHAFT SEAL



The YORK Allis-Chalmers Turbo REFRIGERATION Compressor

Two stationary carbon rings contact opposite sides of a special seal ring which rotates with the shaft for effective sealing. The seal surfaces are accurately finished and sealed with oil from the compressor lubricating system, thereby preventing leakage of refrigerant from the compressor—or air into the compressor. Pressure of the oil is maintained so that the seal is unaffected by changes of pressure due to ordinary operating conditions. The carbon rings are kept always in contact with the shaft seal ring. During shut-downs oil head on the seal is maintained by a gravity oil tank mounted above the seal housing. York Corporation, York, Pennsylvania.

Other outstanding features:

1. Stainless steel impeller blades resist erosion and corrosion assuring perfect wheel balance. Blade rivet heads are eliminated to provide unobstructed gas flow.
2. Low center of gravity of compressor—permitted by trough type cooler—cuts vibration, provides more accessible operation.
3. Balance piston to equalize wheel thrust makes necessary only a positioning thrust bearing, and results in less bearing friction losses.
4. Pre-rotation vanes permit greater capacity reduction (down to 10%.)
5. Permanently silver-sealed condenser joints.

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YORK REFRIGERATION AND AIR CONDITIONING

HEADQUARTERS FOR MECHANICAL COOLING SINCE 1885

be disposed of to wholesalers and other dealers. Wholesalers and other dealers distribute property over the entire country and understand the requirements of consumers located in the areas they serve. Moreover, in many instances, they are best equipped to serve the interest of small retailers who themselves are not in a position to inspect, or for other reasons purchase, surplus property.

We endeavor in all our commercial sales to see that small business participates on an equitable basis, that there is adequate and wide notice of sale, that lot sizes are no larger than those normal to the level of trade being solicited, that descriptions are as accurate as possible, that rural areas receive their fair share of surplus, that there is wide and generally equitable distribution, that there is no adverse impact on industry, employment, or any segment of our economy, that full reports of all sales are available to bidders directly and to the general public through press releases and information available at our regional offices, that normal channels of trade and commerce are utilized, and that as far as possible a fair return is obtained for the people of this country who are the owners of surplus property.

A. U. Fox, director, Office of Surplus Property, before National Business Papers Conference, Washington, May 7, 1945.

NOT SEWAGE DISPOSAL BUT SEWAGE RECOVERY

It is perhaps characteristic of the wasteful economy of the American people that we should refer to sewage disposal instead of sewage recovery. We think of sewage as something to be disposed of by the quickest and cheapest means. From the taxpayers' standpoint, it is interesting to observe that a national sewage recovery project would represent a self-sustaining and self-liquidating investment.

To give you some idea of the profit making possibilities of a sewage recovery plant, let me say that a town of 10,000 people would produce approximately 400 to 600 tons of dehydrated sewage annually. To treat this amount would require an extremely small recovery plant and the proceeds from the sale at $40 per ton would amount to some $16,000 to $24,000 gross annually.

Right now, for the first time in our history, we are confronted with a serious shortage of food of all kinds. The food shortage has not been caused entirely by the war. Unfortunately, we think of food production in terms of grain and whenever we have a bumper grain crop, everyone assumes that the wolf is far from the door. The fact is we never have had a surplus of other than grain foods because of the decreasing fertility of the land and the disappearance of our top soil. As a consequence of our failure to supply the land with sufficient organic manure and fertilizer, our food production per capita has been steadily declining for 20 years. Although the population of the country has increased more than 30 percent in the last 40 years, our production of general foodstuffs has increased only 7 percent.

We can definitely increase the wealth of the nation by providing millions of tons of rich organic fertilizer through the

recovery of sewage, and we, likewise, can increase the wealth of the nation still more by increasing the fish population of our inland rivers, bays and lakes.

All of our great inland cities draw their drinking water from the stream into which their sewage is emptied. This water is filtered, treated, sterilized and purified to such an extent that to take a drink of water in some inland cities is like drinking a solution of chlorine. Every town and city spends millions of dollars annually in operating water treating plants to protect the health of their citizens. If the water reaching these plants weren't polluted with sewage the cost of operating them would be so much less because it would be merely necessary as a precautionary measure to add chlorine.

When you look at your national sanitation program from the standpoint of the federal government, it is at once apparent that the construction of sewage recovery plants in every city, town and village having a sewer system would be an ideal means of spreading work because each project would be a local affair and it could be carried out by local workmen.

To summarize the program, it is proposed that the cooperation of everybody be ensured by the passage of a federal law making it illegal for polluted water to flow from one state to another or into the sea. It is obvious that every community having a sewer would be forced to cooperate. The project should be financed by the federal government in the form of loans to communities. These loans should be made on the basis that the plant will be maintained and the loan retired from the proceeds of the sale of fertilizer.

Frank Chilson, industrial consultant, before Rotary Club of Clinton-Madison-Guilford, Conn., June 21, 1945.

FOREIGN LITERATURE ABSTRACTS

BACTERICIDAL PAINTS

Bactericidal value of various pigments, disinfectants and new mediums which may be used to increase the bactericidal power of oil paints, was tested with typhoid bacillus and staphylococcus. Degree of sterility was observed after 1, 3, 6 and 15 days of drying. Differences were observed during the first 6 days in pigments most commonly used in industry, but after 15 days all the paints were highly contaminated. The following pigments were tested: basic lead carbonate, sublimated lead carbonate, zinc oxide, titanium oxide, lithopone, zinc sulphide, titanium white with a baritic, asbestos and clay base. Phenol resins used in paints also lost their bactericidal action at the end of 15 days. Even *p*-chloro-*m*-cresol, hydroxyquinolein sulphate and other powerful agents were inadequate for this purpose. In examining the sterility of certain old wood boards, however, it was found that they contained halogenated drying oils which were responsible for the continued sterility. This discovery led to a new

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method for preparation of oil paints with persistent sterility, even after three months of drying. An investigation was made on the activity of the chlorinated oils as a function of their chlorine content and it was found that oil which had absorbed 3.5 percent killed typhoid bacillus and 4 percent killed staphylococcus.

Digest from "Encaustics, Paints and Bactericial and Fungicidal Coatings" by J. B., *La Rev. des Prod. Chim.*, November, 1943. (Published in France.)

POTASSIUM PERSULPHATE IN THE TEXTILE INDUSTRY

POTASSIUM persulphate is used as an oxidizing agent in dyeing and printing establishments and is especially good in the oxidation of indanthrene, algol, ciba, ponsol, sulphanthrene, sausothrene and similar dyes. When fabrics are immersed in baths of 3-5 thousandths of potassium persulphate for about two minutes at a temperature of 40-50 deg. C., resulting oxidations are not only superior to analogous oxidation procedure with bichromate but have many valuable properties. The solution is colorless and has no effect on light colors or on whites but, on the contrary, has a bleaching effect. The reaction is fast and therefore avoids possible discharges which may sometimes occur from excessive reduction. Indigosol and analogous dyes are oxidized perfectly with potassium persulphate, giving pure tones and maximum yield. Potassium persulphate is excellent for sulphur colors since these colors take on a vividness and brilliance which has not been obtained with any other product so far. In addition to its use with these and other dyes, potassium persulphate is used in a saturated solution, in the cold, as an oxidizing agent (or 1 percent ammonium persulphate) in analysis for determination of the coloring used in the dye of a sample (the Green method is the one most widely known and used).

Digest from "Applications of Potassium Persulphate in the Textile Industry" by D. Blanxart, *Ion* IV, No. 40-41, 892-893, 1944. (Published in Spain.)

EVAPORATION AND DISTILLATION BY THERMOCOMPRESSION

NUMEROUS industries require concentration of aqueous solutions by evaporation of the solvent as, for example, in concentration of soda or sulphite liquors, refining of salts by successive dissolvings, concentration of organic materials in the sugar industry, canned food, evaporated milk, gelatin, etc., and distillation of aqueous liquids. These two operations can be carried out with thermocompression, in which procedure the vapor produced in the concentration or distillation operations is used to evaporate or distill a fresh quantity of liquid. Unlike the multiple-effect system, in thermocompression the pressure is kept constant in the one concentrator apparatus and the pressure of the vapor produced increases, so that the quantity of heat produced by the heat of vaporization of the vapor reaches a higher thermal level and remains ready to be conveyed to the liquid by the vapor. Thermocompression is based on the fact that a relatively small quantity of energy is required in order to raise the

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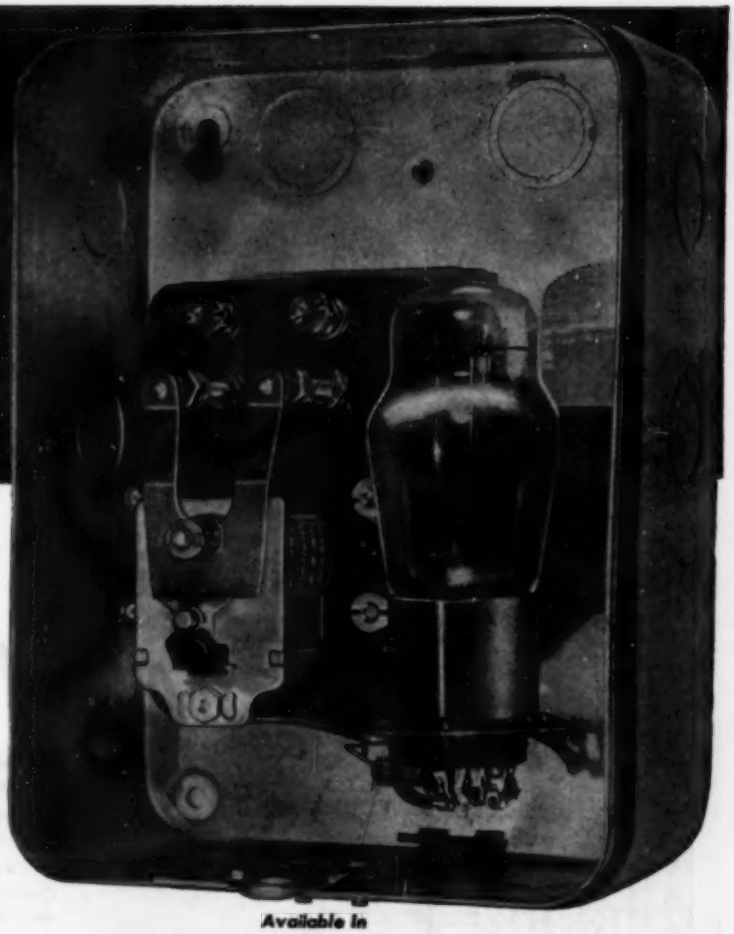

This grid controlled half-wave rectifier combines in one compact unit, all of the functions of a pair or series of relays as commonly used to handle up to 30 amperes output.

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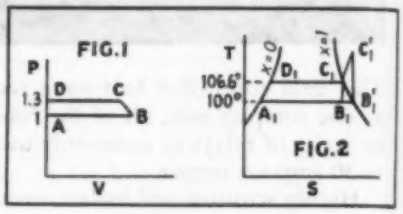
vapor generated from a liquid to the same thermal conditions as those of the live steam originally used, and then to be able to use it for the same purpose. For example, if a liquid which is to be concentrated attains 100 deg. (1 atm.) and the live steam used to heat it is at 106.6 deg. (1.3 atm.), approximately 625 cal. are necessary to produce 1 kg. of the latter (starting with water at 15 deg. and disregarding losses of heat). A kilogram of steam saturated at 100 deg. can be converted to steam saturated at 106.6 deg., however, by compressing to 1.3 atm. This is illustrated by Fig. 1 in which *AB* represents suction of the vapor at 1 atm., *BC* is the adiabatic compression of the drawn-in

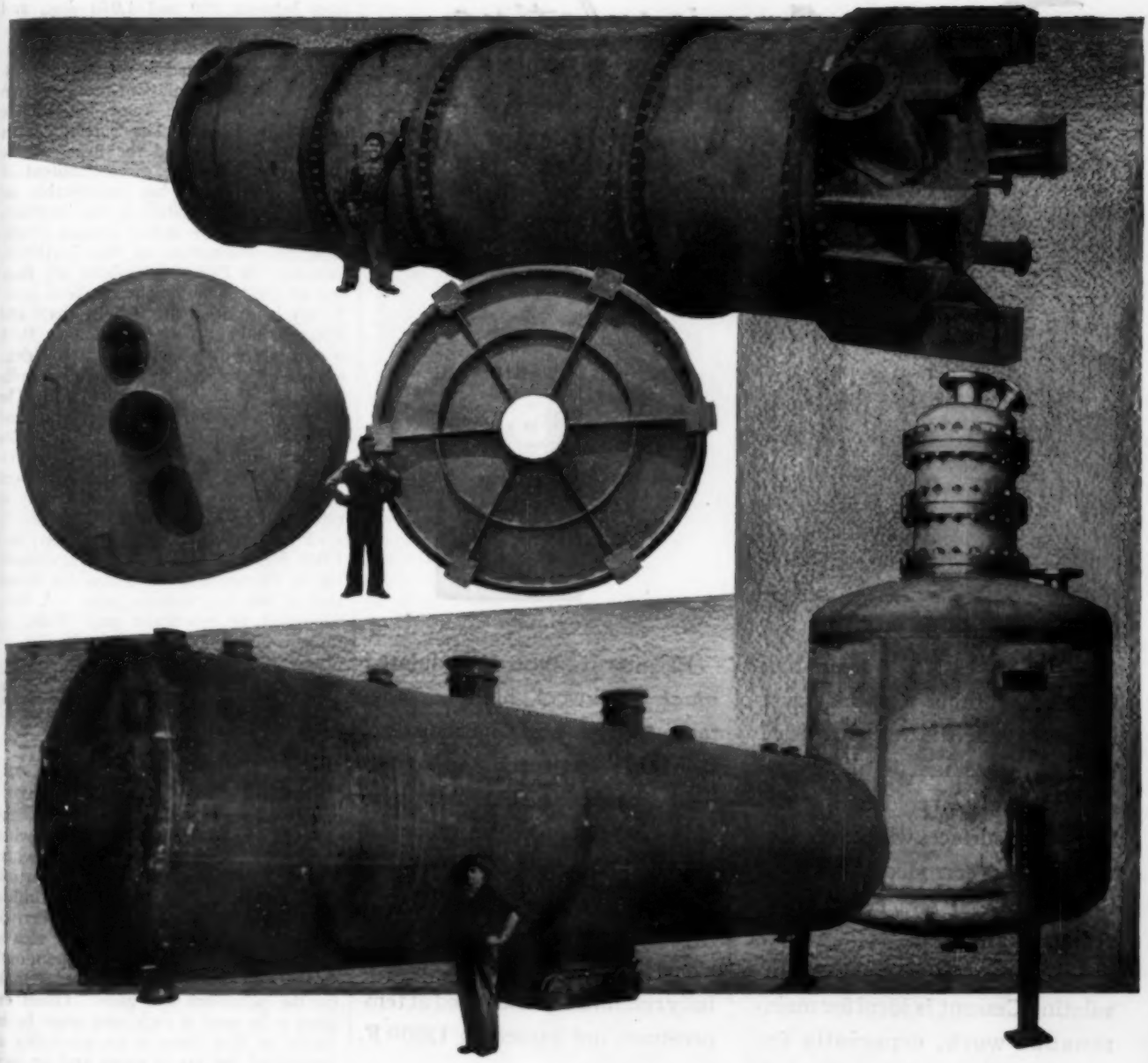


vapor until it reaches the pressure of 1.3 atm., *CD* the exhaust of the vapor thus originated at that pressure and conveyed to the consuming apparatus. The work done is determined by the area of the mixtilinear trapezoid *ABCD*. The same thermic cycle can also be represented in the system *TS* of Fig. 2. $A_1B_1C_1D_1$ corresponds to the hypothesis that B_1 is such that the adiabatic compression B_1C_1 raises the vapor to the dry saturated state C_1 $(x=1)$. A_1 B'_1 C'_1 C_1D_1 corresponds, on the other hand, to the hypothesis that the vapor is already dry saturated in B'_1 and that it is then reheated (diagram $B'_1C'_1$) during the first phase of the compression, then re-establishing itself to continue the transformation C'_1C_1, the dry saturated state. The work corresponding to the first cycle given for the area *ABCD* is hardly 4,100 kg. per kg. of vapor, corresponding to 0.015 hp-hr. and equivalent to only $4{,}100/427 = 9.6$ cal.

Digest from "Evaporation and Distillation with Thermocompression" by Luciano Cabala, *Revista de Ingeniería Química*, Universidad de Concepción, III, No. 3, 105-113, 1944. (Published in Chile.)

BERYLLIUM HARDENING

WORK was done on diffusion of beryllium in the solid state in various metals, particularly iron, steel, nickel, copper and alloys, to increase hardness of such materials. Depth of penetration was determined in relation to temperature, composition of the cementing alloy, and time. It was found that diffusion of beryllium in the solid state in iron usually begins at 800 deg. and continues at a rapidly increasing rate at over 950 deg. Best conditions are obtained by using 70 percent powder alloys. Above this value the rate of diffusion decreases. Diffusion does occur with alloys of low concentration, 18-20 percent, in the case of iron, but it is very poor. At a high temperature there is a tendency for the compound $FeBe_2$ to form in the peripheral layer. Three basic zones were observed: solid iron $FeBe_2$ solution for low temperatures, eutectic zone between said solution of $FeBe_2$ for tempera-



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tures between 900 and 1,050 deg., and formation of $FeBe_2$ for higher temperatures. The hardness of the beryllium-treated layer is related to the structure, although the solid solutions can undergo hardening in certain cases by suitable thermal treatment. The eutectic zones are naturally hard and the hypereutectic ones very hard. The carbon content of the treated material has considerable influence on the formation of the beryllium layer. The presence of that element greatly facilitates penetration of the beryllium, formation of $FeBe_2$ and, above all, firmness of the beryllium-rich peripheral layer. A very hard layer with a $FeBe_2$ base and several hundredths of a millimeter thick is obtained with pure iron at 1,100 deg., whereas thicknesses of tenths of a millimeter are obtained with hard steel. The probable formation of a ternary compound of iron-beryllium-carbon was deduced from all the chemical and micrographic observations. The characteristic zones have been determined in relation to the quantity of carbon in the material. It is necessary to work between 1,080 deg. (pure iron) and 1,000 deg. (0.86 percent carbon), depending on the quantity of carbon, for formation of the hypereutectic zone. A layer composed of practically pure $FeBe_2$ is formed only from 1,100 to 1,150 deg.

Digest from "Study of Beryllium. Report VII: Superficial Hardening by Diffusion of Beryllium" by L. Losana and C. Goria, *Metall. Ital.* **43**, 35, 1943. (Published in Italy.)

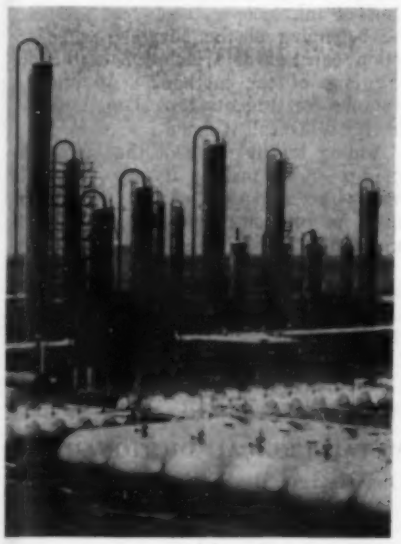
DIESEL ENGINES IN OIL WELL DRILLING

TEMPERATURE of exhaust gases and diesel engine parts is very important when these machines are installed in places where there is danger of ignition of combustible or explosive mixtures. In oil well drilling the danger zone includes the oil derrick, the adjoining buildings and all the area in a radius of 20-30 meters around the mouth of the well, as well as the storage tanks for the petroleum and gases. Diesel engines to be used in such areas must be installed so that there is no possibility of ignition of the gas or vapor and air mixtures, either by spark or formation of flame or by excess heat. Dangerous formation of sparks or flame is possible during operation for various reasons. Sparks may be emitted when there is poor combustion or cooling. There is also possibility of ignition by excess heating of certain parts of the engine and an excessively high temperature of the exhaust gases and pipes. Certain standards must be maintained in order to avoid these dangers, the maximum permissible temperature being 200 deg. It is possible, however, to increase this temperature limit somewhat, since the ignition point of the average petroleum-gas-air mixture rises to 500-550 deg., but the hot parts of the machine must not be dirty with oil and petroleum residue, cotton waste used in cleaning or other such material and there must be good ventilation. Under such conditions the maximum temperature of the machine parts can be 300 deg.

Digest from "Temperatures of Exhaust Gases and of Surfaces of Diesel Engines in Oil Well Drilling Installations" by O. Sanner, *Oel u. Kohle*, **40**, 171, 1944. (Published in Germany.)

CHEMICAL ENGINEER'S BOOKSHELF

LESTER B. POPE, Assistant Editor



Fractionating towers and butane and propane storage tanks at the new Celanese plant in Texas where acetic acid and other chemicals are being made

TEXAN RESOURCES

TEXAS LOOKS AHEAD. *Vol. 1, The Resources of Texas. Edited by Lorena Drummond. Published by the University of Texas, Austin, Texas. 365 pages. Price $1.*

Reviewed by James A. Lee

THIS is the first of two volumes dealing with developments in Texas in the postwar period. While they are intended primarily for the benefit of the people of that state, the contents of at least this first volume are of interest far beyond the borders of the Lone Star State. It is therefore commended to all others who are interested in the future industrial development in the Southwest.

If the material stopped with the treatment of the natural resources—mineral, marine and forest—it would be valuable for reference purposes, but the planners went on and arranged for the treatment of the industrial developments. Of particular interest to many chemical engineers are the chapters dealing with Pharmaceutical Opportunities, What the State Has Done Industrially, and Chemical Industries in the Postwar World.

There are several paragraphs on each chemical process industry plant, giving such information as location, contractor, owner, products, raw materials, capacity and investment. A particularly fine job has been done in discussing the trends in the chemical industry of the entire country as well as in the state of Texas. The possibilities for a considerably expanded chemical industry on the Gulf Coast are well worth reading.

MULTIPLY BY

CONVERSION FACTORS AND TABLES. *By O. T. Zimmerman and Irvin Lavine. Published by Industrial Research Service, Dover, N. H. 262 pages. Price $2.75.*

A ROUGH calculation indicates that there are more than 6,000 entries in this little book of conversion factors. Each gives a multiplier to convert from one unit of measurement to another. All sorts are listed—from common engineering terms such as B.t.u., miles, pounds and r.p.m. to unusual units like cubits, kines, labors and spaces. In addition, there are temperature, hydrometer and viscosity conversion tables. The book should prove to be a handy and useful reference and desk companion for all engineers.

FEDERAL TAX POLICY

PRODUCTION, JOBS AND TAXES. *By Harold M. Groves. Published by McGraw-Hill Book Co., New York. 116 pages. Price $1.25.*

Reviewed by Blaine McKee

Production, Jobs, and Taxes, the study of a postwar federal tax policy, is the first of a series of reports to be published under the auspices of the Committee for Economic Development, an independent, nonpolitical corporation, organized by American businessmen to promote the attainment of high levels of production and employment in the United States after the war. The author, a professor of economics at the University of Wisconsin, has had much experience in public finance. Briefly, he reviews our present tax system and offers suggestions for postwar improvement. His recommendations are not likely to be popular with the liberal party, for he favors the elimination of business taxes to encourage and stimulate business, and the maintenance of a high income tax rate. "If business taxes do reduce investment, employment, and national income, and other taxes can be found that would not do this, then the price we pay for business taxes is too high. Their elimination would mean higher personal incomes, a larger tax base, and greater general welfare." He argues against the belief that inanimate objects, such as corporations, can bear taxes. They can make the payment, but the burden must fall on the owners, workers, or the customers. Dr. Grove sees corporate taxes partly as a "sales tax in disguise."

Although Dr. Groves advocates the maintenance of high income tax rates after the war, he favors some moderation in the rates as they apply to the upper and middle level of income, because the present high rates, as high as 90 percent, discourage investments by people in these groups. Among other changes he also favors the elimination of tax exempt government securities, and the strengthening of the inheritance tax.

In this short review, Dr. Groves covers a lot of territory, reviews the history of the field, discusses the different possibilities, and finally offers his recommendations. Regardless of one's personal opinion on taxes, he will find *Production, Jobs, and Taxes* an informative and timely book.

ANALYTICAL TECHNIQUES

THE ANALYSIS OF FOODS. *By Andrew L. Winton and Kate Barber Winton. Published by John Wiley & Sons, New York. 946 pages. Price $12.*

Reviewed by F. K. Lawler

THIS volume constitutes a comprehensive and authoritative compilation of practical information for practicing food analysts engaged in Federal, State or municipal inspection, in quality control in the plant, and in research and testing in the laboratory. And it is so arranged as to be useful to the student and beginner.

Of the methods described, some have been adopted by American national organizations or are standard in other countries. Those not yet accepted as "official" methods were developed in reliable laboratories and published in accredited journals. A notable accomplishment of the authors is the separation of the method proper from its entanglement with discussion and the piecing together of the parts to form a concise and usable whole.

The contents are arranged in two parts —general methods and specific ones. The first part includes microscopic, physical and chemical methods, the latter being presented under the headings of water, protein, fat, nitrogen-free extract, fiber, ash, alcohols, vitamins, natural colors, artificial colors and chemical preservatives. This may or may not be as convenient to a par-

RECENT BOOKS RECEIVED

Conversion Factors and Tables. By O. T. Zimmerman & I. Lavine. Industrial Research Service. $2.75.

Photosynthesis and Related Processes. By E. I. Rabinowitch. Interscience. $8.50.

Piping Handbook. 4th ed. By S. Crocker. McGraw-Hill. $7.

Secrets of Industry. By L. C. Ord. Emerson Books. $3.

Studies in Biophysics: The Critical Temperature of Serum. By L. du Nouy. Reinhold. $3.50.

Thermodynamic Properties of Air. By J. H. Keenan & J. Kaye. Wiley. $2.25.

Training for Supervision in Industry. By G. H. Fern. McGraw-Hill. $2.

The Useful Soybean. By M. Lager. McGraw-Hill. $2.75.

ticular analyst as classification under the different food products, but it is a long-used technique. The special methods given in the second part pertain to cereals, fats, vegetables, fruits, saccharine, alcoholic beverages, dairy products, animal foods, alkaloidal products, flavors, leaven and salt.

Introducing the parts an analytical methods is a section briefly describing the apparatus and reagents used. Illustrations of microscopic tissues are given at the beginning of the chapters, while reaction equations are included in the descriptions of the methods. As practice examples for students, typical methods are described in explicit detail.

Adding to the value of the volume is a 53-p. index making it easy to locate among the 946 pages of text a particular bit of information required in an analytical procedure.

The work reflects the background of the authors. Andrew L. Winton not only has had experience as a state and federal chemist, but he revised and enlarged Leach's "Food Inspection and Analysis." Kate Barber Winton has served as a state and federal microscopist.

METALLURGICAL DICTIONARY

GERMAN-ENGLISH DICTIONARY OF METALLURGY. *By T. E. R. Singer. Published by McGraw-Hill Book Co., New York. 298 pages. Price $4.*

THIS new dictionary will be found useful by technical men who need to refer to German literature on metallurgy and mining. It is convenient in size and reasonably priced.

COLLEGE INORGANIC

GENERAL CHEMISTRY. *By John A. Timm. Published by McGraw-Hill Book Co., New York. 692 pages. Price $3.75.*

PROFESSOR TIMM has done a good job. His textbook is modern in approach, complete, accurate and his conversational style makes the facts readily assimilable. In 55 chapters he presents the material of a college course in inorganic chemistry in a way that will surely bring wide acceptance to his text.

SYMPOSIA

PROTECTIVE AND DECORATIVE COATINGS. *Edited by J. J. Mattiello. Published by Office of the Quartermaster General. Available from Superintendent of Documents, Washington 25, D. C. 349 pages. Price $1.25.*

IN THIS work is made generally available a series of lectures by some 24 specialists in the organic coatings industry prepared originally for the benefit of those individuals in the Army, Navy, WPB and other agencies whose duties required that they be posted on the latest developments in organic coatings technology. Prime purpose of the lectures was to round up authoritative technological information for an attack on the three most pressing problems facing the coatings industry, namely, the shifting availability of raw materials, the conservation of materials, and the preparation of workable specifications.

As used here the term "coatings" includes paints, varnishes, lacquers, textile

coatings, and plastics, with specific emphasis on wartime advances in synthetic oils, synthetic resins, solvents, thinners, dryers, pigments and plastics. Other chapters cover the subjects of "color," luminescent materials, and reflectance studies of pigments. The original charts, photographs, and discussions from the floor have been retained in the compilation, and an index to the whole series has been added. In its approach, "Protective and Decorative Coatings" is concerned, not with recipes and specific formulations, but with the inherent characteristics of basic materials which govern their behavior in any formulation.

GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington 25, D. C. In ordering any publications noted in this list always give the complete title and the issuing office. Remittances should be made by postal money order, coupons, or check. Do not send postage stamps. All publications are in paper cover unless otherwise specified. When no price is indicated, pamphlet is free and should be ordered from the bureau responsible for its issue.

Trade Practice Rules for the Low Pressure Refrigerants Industry as Promulgated June 30, 1945. Federal Trade Commission.

Tungsten Deposits in Beaver County, Utah. By S. W. Hobbs. Geological Survey. Bulletin 945-D. Price 65 cents.

Detonators: Initiating Efficiency by the Miniature-Cartridge Test. By R. L. Grant and J. E. Tiffany. Bureau of Mines. Technical Paper 677. Price 10 cents.

Solid-Fuel-Burning Forced-Air Furnaces. Bureau of Standards. Commercial Standard CS109-44. Price 10 cents.

Studies in Redistillation of Carbothermic Magnesium. By H. A. Doerner, W. F. Holbrook, Lloyd R. Michels and others. Bureau of Mines. Report of Investigation R.I. 3806. Mimeographed.

National Motor-Gasoline Survey Winter 1944–45. By O. C. Blade. Bureau of Mines. Report of Investigations R.I. 3820. Mimeographed.

Annual Report of Research and Technologic Work on Coal, Fiscal Year 1944. By A. C. Fieldner, P. L. Fischer, and R. E. Brewer. Bureau of Mines. Information Circular I. C. 7322. Mimeographed.

Fishery Statistics of the United States 1941. By R. H. Fiedler. Fish and Wildlife Service. Statistical Digest No. 7. Price 25 cents.

Doing Business with Russia. Bureau of Foreign and Domestic Commerce. International Reference Service, Volume 2, Number 8. Price 5 cents.

Suction Apparatus, Portable, Electric. War Department Technical Manual TM 8-618. Price 10 cents.

Modern Books on Horology. Bureau of Standards. Letter Circular LC766. Mimeographed.

Directory of Labor Market Areas. War Manpower Commission. Price 25 cents.

Science—The Endless Frontier. Report to the President on a Program for Postwar Scientific Research. By Vanneyar Bush. Office of Scientific Research and Development. Price 30 cents.

The Government's Wartime Research and De-

velopment, 1940-44. Part II. Findings and Recommendations. Report from the Subcommittee on War Mobilization to the Committee on Military Affairs. Subcommittee Report No. 5.

The Road to Tokyo and Beyond. 3rd Report to the President by Director of War Mobilization and Reconversion. Price 15 cents.

War Production in 1944. Report of the Chairman of the War Production Board. Price 25 cents.

The Geographic Distribution of Manufacturing Facilities Expansion July 1940-May 1944. War Production Board, Program and Statistics Bureau, Facilities Branch. Mimeographed.

Report on the Rubber Program 1940-1945. Rubber Reserve Company.

Accredited Higher Institutions 1944. By Alla B. Ratcliffe. Office of Education. Bulletin 1944, No. 3. Price 25 cents.

Survey of the Suitability of Domestic Talcs for High-Frequency Insulators. By Theron A. Klinefelter, Sidney Speil, and Sidney Gottlieb. Bureau of Mines. Report of Investigations R.I. 3804. Mimeographed.

Effect of Pressure on Ignition Temperature of Acetylene and Acetylene-Air Mixtures. By G. W. Jones and R. E. Kennedy. Bureau of Mines. Report of Investigations R.I. 3809. Mimeographed.

Improvement of Labor-Utilization Procedures. Bureau of Labor Statistics. Bulletin No. 807. Price 10 cents. Recommended methods for selection, training and guidance.

Commercial Electric-Refrigeration Condensing Units. Bureau of Standards. Commercial Standard CS107-45. Price 10 cents.

Guide for Cutting Allegheny Northern Hardwoods. Department of Agriculture, Forest Service. AIS-3. Free. A practical woods guide; one of a series which describes good practice in various parts of the country.

Accidents from Falls of Rock or Ore in Metal Mines. Bureau of Mines. Miners' Circular 52. Price 10 cents.

Debittering Soybeans. List of patents for removing the bitter taste from soybeans. By A. K. Smith. Bureau of Agricultural and Industrial Chemistry. AIC-73. Mimeographed.

Calibration of Arc Lamps for Testing Colorfastness to Light. Bureau of Standards. Letter Circular LC785. Mimeographed.

Making Starch from Wheat Flour. By R. J. Dimler. Bureau of Agricultural and Industrial Chemistry, AIC-68. Mimeographed.

New or revised specifications which make up Federal Standard Stock Catalog have been issued on the following items: Ammonium-Chloride (Sal Ammoniac), Technical Grade; O-A-491a. Drums, Steel, Type 5B (for Petroleum Products); RR-D-729. Stain, Opaque, Wood, Exterior, Oil; TT-S-706.

RECENT BOOKS & PAMPHLETS

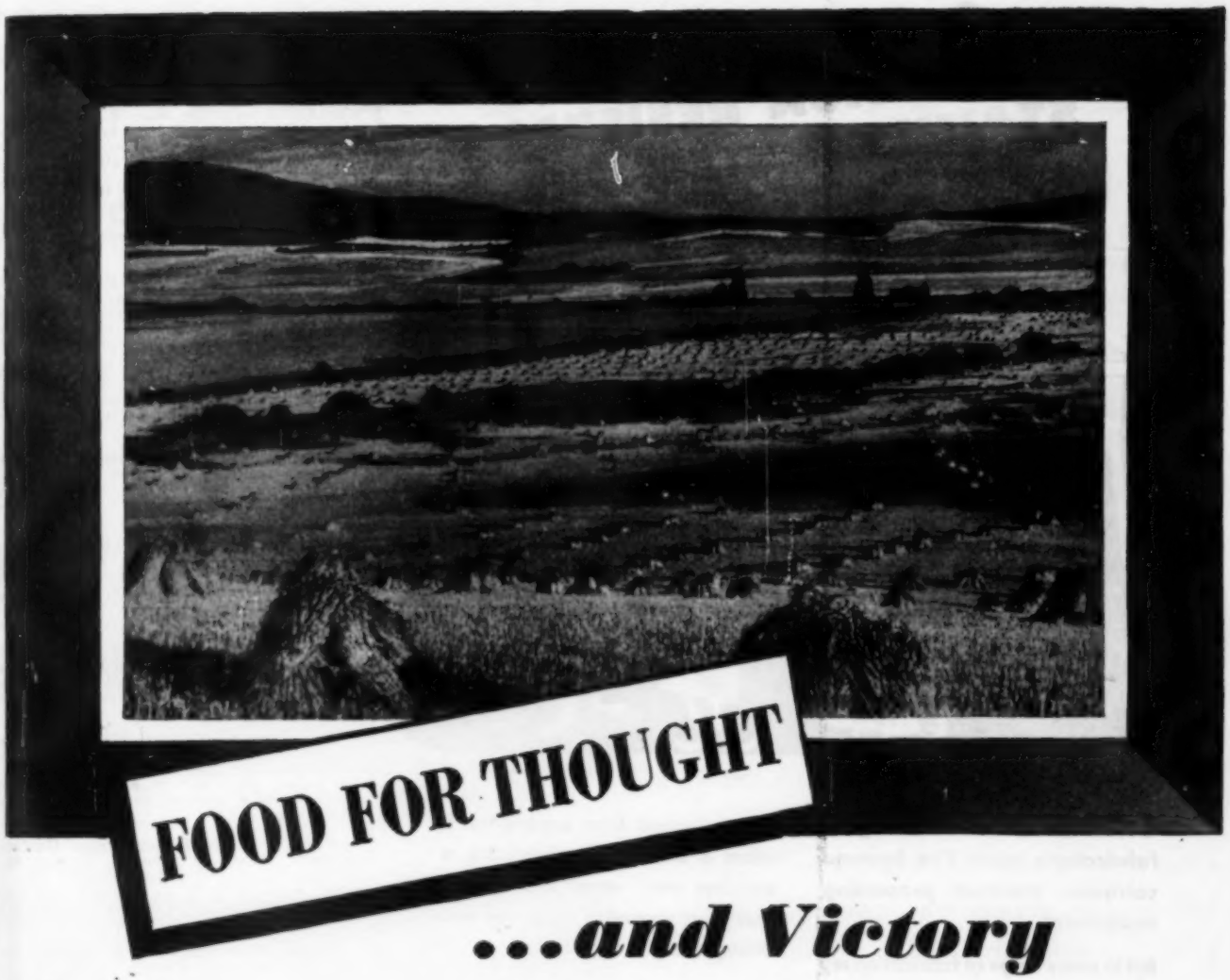
Determination of Economically-Optimum Pressing Times for Hydraulic-Press Extraction of Cottonseed Oil. By W. H. Baskervill and A. C. Wamble. Bulletin No. 13, published by The University of Tennessee Engineering Experiment Station, Knoxville, Tenn. 21 pages. Results of a study based on data obtained in a pilot plant and in eight commercial oil mills.

The Biological, Hygienic, and Medical Properties of Zinc and Zinc Compounds. By D. M. Hegsted, J. M. McKibbin and C. K. Drinker. Available from American Zinc Institute, 60 E. 42nd St., New York 17, N. Y. 44 pages. Gratis. An authoritative study published as Supplement No. 179 to the U. S. Public Health Reports.

U. S. Government Paint Specifications. Ninth edition. By G. G. Sword. Circular 702. Published by National Paint, Varnish and Lacquer Association, 1500 Rhode Island Ave., N.W., Washington, D. C. Complete listing of the specifications used by the government for paint and paint-materials purchasing.

Twelfth Annual Report. Published by Engineers' Council for Professional Development, 29 W. 39th St., New York 18, N. Y. 56 pages. For the year ending Sept. 30, 1944.

Sillimanite and Massive Kyanite in Georgia. By A. S. Furcon and K. H. Teague. Geological Survey Bulletin No. 51, published by Georgia Department of Mines, Mining and Geology. At-



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lanta. 76 pages. Geology, classification, distribution, uses and other economic features.

Straight Talk for Disabled Veterans. By Edna Yost. Pamphlet No. 106, published by Public Affairs Committee, 30 Rockefeller Plaza, New York 20, N. Y. 31 pages. Price 10 cents. Wounded veterans are assured that in most cases earning capacity need not be impaired even by serious disability. They are warned, however, that success comes only with great effort.

Youth and Your Community. By Alice Weitz. Pamphlet No. 108, published by Public Affairs Committee, 30 Rockefeller Plaza, New York 20, N. Y. 31 pages. Price 10 cents. Ten specific steps advocated to meet a crisis.

How To Do Business With RFC. Published by Reconstruction Finance Corp., Washington, D. C. 32 pages. Listing of approximately 3,000 items of government-owned surplus property which RFC handles as a disposal agency.

Conference Report on New Developments in Wood Products. Published by The New York State College of Forestry, Syracuse University, Syracuse. 144 pages. Proceedings of a conference held last October.

Books, Publications and Patents of Battelle Memorial Institute, 1929–1944 Published by the Institute, Columbus, Ohio. 72 pages. Publications and patents resulting from 15 years of research.

Studies in Biophysics: The Critical Temperature of Serum (56°). By L. du Noüy. Published by Reinhold Publishing Corp., New York, N. Y. 185 pages. Price $3.50. Interpretation of new facts brought to light by means of a hypothesis concerning the structure and behavior of the serum molecule.

Sulfation in Roasting Zinc Sulfide Concentrates. By H. R. Hanley. Technical Series Bulletin published by Missouri School of Mines, Rolla, Mo. 22 pages.

Theory and Applications of Electron Tubes. Second edition. By Herbert J. Reich. Published by McGraw-Hill Book Co., New York 18, N. Y. 716 pages. Price $5. Thorough discussion of fundamentals of tubes for both radio and industrial applications.

Essentials of Kiln Drying Oregon Hardwood Lumber. By Glenn Voorhies, Oregon State College, School of Forestry, Corvallis, Ore. 17 pages. Research Leaflet 2, illustrated with charts and photographs, giving results of research on the kiln drying of hardwood lumber.

Oregon, the Beaver State. By Robert S. Farrell, Jr., Secretary of State, Salem, Ore. 16 pages. An illustrated introduction to the resources and other attractions of Oregon. Includes a map of the state.

Where We Stand on Postwar Planning. Published by Seattle Chamber of Commerce, Seattle, Wash. 12 pages. A pamphlet outlining the program and work of the Seattle committee for economic development of resources of the region.

Comparative Tax Rates in Oregon Cities, 1944–45. Information Bulletin 60, published by University of Oregon, Bureau of Municipal Research and League of Oregon Cities, Eugene, Ore. 10 pages. Detailed data on comparative tax rates in the leading Oregon cities.

Build Your Future in the New World of Plastics. Published by Plastics Industries Technical Institute, Western Ave. at Venice Blvd., Los Angeles, Calif. 20 pages. Courses of instruction and training facilities of this school. Includes a detailed description of the curriculum offered.

Commercial Minerals of California. By George L. Gary. Bulletin No. 124, published by the Division of Mines, Department of Natural Resources, State of California, Ferry Building, San Francisco, Calif. Price $1. A series of mimeographed papers dealing with the occurrence, preparation, uses, tests, markets and possible buyers of California's critical ore minerals needed for the war program. Each mineral is dealt with separately and a total of 45 minerals or mineral families is covered.

Forest Resources of Snohomish County. By Robert D. Peterson. Published by Washington State Planning Council, Olympia, Wash. 41 pages. Covers forest resources and utilization, both industrial and farm forestry. Contains tables of statistics, maps, charts and graphs.

Commerce of Snohomish County. Published by Washington State Planning Council, Olympia, Wash. 36 pages. Resume of commercial waterways, waterborne commerce, port and harbor facilities, expansion of port facilities and transport. Several tables of statistics; photographs and maps.

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MANUFACTURERS' LATEST PUBLICATIONS

Publications listed here are available from the manufacturers themselves, without cost unless a price is specifically mentioned. To limit the circulation of their literature to responsible engineers, production men and industrial executives, manufacturers usually specify that requests be made on business letterheads.

Abrasives. The Carborundum Co., Niagara Falls, N. Y.—84-page book containing information about coated abrasives including an explanation of the new end use names for all coated abrasive products. Contains comprehensive recommendations for the use of coated abrasive products in a number of different types of industries.

Aluminum Bronze. Ampco Metals, Inc., 1745 S. 38th St., Milwaukee 4, Wis.—Bulletin 71. Illustrated booklet describing the services and facilities which this company offers. Bulletin 67. 4-page leaflet describing all types of welded assemblies fabricated by this company. Data sheet No. 134. Leaflet describing electrical conductivity alloys for various purposes in several industries.

Batteries. Ideal Commutator Dresser Co., 1286 Park Ave., Sycamore, Ill.—4-page leaflet featuring rechargeable flashlight storage batteries, battery chargers, and testers.

Boilers. Titusville Iron Works Co., Titusville, Pa.—Bulletin B3000. 8-page illustrated booklet describing both hand fired and mechanical fired heating boilers built by this company. Specifications and dimensions are included.

Chemicals. Calco Chemical Division. American Cyanamid Co., Bound Brook, N. J.—Technical Bulletin No. 773. Bulletin entitled "Statistical Analysis of Test Data" describing methods for quality control in production and analysis of experimental data. Technical Bulletin No. 775. Bulletin entitled "Effect of Resin Treatment on Spun Viscose Rayon Dyed Calcomine and Calcidur Colors." This bulletin has been prepared to serve as a guide in the selection of dyes for the dyeing of spun viscose rayon fabrics.

Chemical Equipment. General Ceramics & Steatite Corp., Keasbey, N. J.—Bulletin CH.E-R. 8-page catalog illustrating the various type of ceramic and steatite equipment made by this company.

Compressors. Clark Bros. Co., Inc., Olean, N. Y.—15-page booklet featuring an article on the effect of super-compressibility of natural gas upon compressor performance.

Crystallizers. Swenson Evaporator Co., Division of Whiting Corp., Harvey, Ill.—8-page bulletin describing the important features, applications, sizes and capacities, together with construction and operation data for this company's line of vacuum crystallizers.

Dryers. General American Processing Equipment Division, 450 Baxter Ave., Louisville 4, Ky.—Bulletin No. 54. 8-page illustrated booklet describing the features of the Louisville countercurrent and parallel current direct heat dryers.

Electric Equipment. Electric Machinery Mfg. Co., Minneapolis 13, Minn.—20-page booklet describing power factor, what it is, and how it is used.

Electric Equipment. Wagner Electric Corp., 6400 Plymouth Ave., St. Louis 14, Mo.—Bulletin GU-86. 16-page booklet illustrates and describes briefly the entire line of electrical and automotive products made by this company including motors, transformers, industrial brakes, controls, hydraulic brakes, air brakes, recording speedometers and other equipment.

Electronics. Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.—Bulletin E6358. 20-page booklet discussing the principles of electronics, electronic tubes and other similar equipment.

Electrostatic Spraying. Pemco Corp., Baltimore 24, Md.—14-page reprint describing the electrostatic spraying of porcelain enamels in which emphasis is placed on the preparation of enamel for this spraying operation. The appli-

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Fig. 1571
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Fig. 123, "N-M-D"
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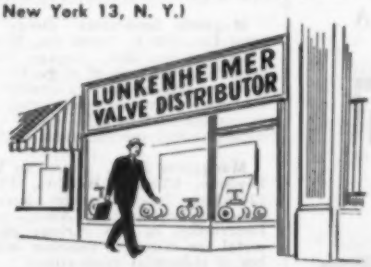

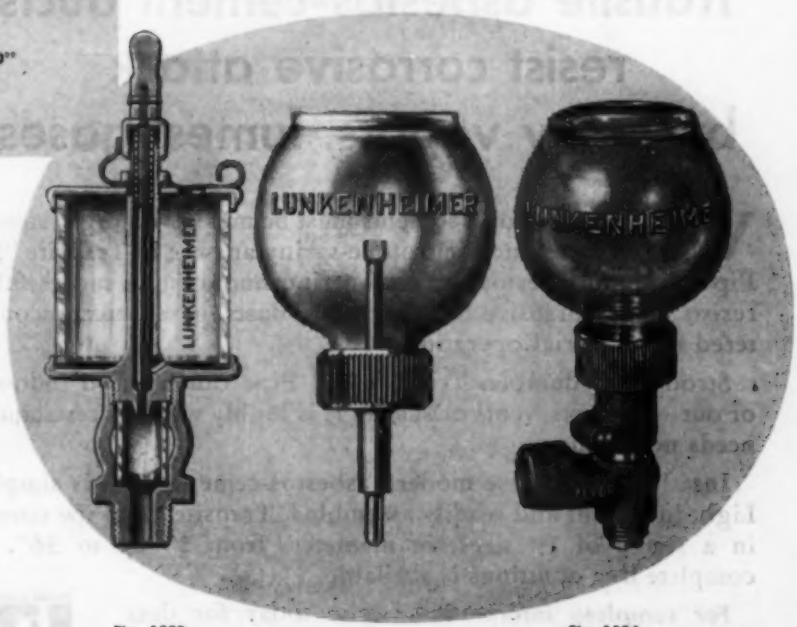

Fig. 1300
"Sentinel" Oil Cup
with Sight Feed

Fig. 1815
Bottle Oiler

Fig. 1834
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cability and limitations on the use of this type of equipment in the porcelain enamel industry are considered.

Equipment. Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.—Bulletin B6057. 32-page directory of the entire line of products and equipment made by this company.

Ethyl Silicate. Carbide & Carbon Chemicals Corp., 30 E. 42nd St., New York 17, N. Y.—Form 5989. 10-page illustrated booklet discusses the hydrolysis of ethyl silicate and its uses as a source of silica. Applications of ethyl silicate illustrating its various uses are included.

Evaporative Coolers. Worthington Pump & Machinery Co., Harrison, N. J.—Bulletin C-1100-B27. 6-page illustrated booklet describing evaporative coolers made by this company. Contains specifications, selection tables and application data.

Fire Protection. Grinnell Co., Inc., Providence 1, R. I.—4-page illustrated folder describing the Flamebuster, a three purpose hose nozzle for solid stream, high or low velocity flame spray applications. This nozzle may be used with water, foam or chemicals for putting out all types of fires.

Floor Cleaners. L. Sonneborn Sons, Inc., 88 Lexington Ave., New York 16, N. Y.—4-page illustrated folder describing floor cleaning apparatus which both waxes and cleans various types of commercial and industrial floors.

Forgings. Titusville Forge Division, Titusville, Pa.—8-page illustrated bulletin describing the engineering facilities and services for the production of precision forgings for all purposes.

Instruments. Askania Regulator Co., 1603 So. Michigan Ave., Chicago 16, Ill.—Technical paper No. 100. 16-page booklet illustrating and describing the process control terms proposed by the Terminology Committee of the Industrial Instrument and Regulators Division, ASME.

Instruments. Barton Instrument Co., 2306 E. 38th St., Los Angeles 11, Calif.—Bulletin 11C1. 2-page leaflet describing the differential pressure type dial indicator with alarm contact made by this company.

Instruments. The Bristol Co., Waterbury 91, Conn.—Bulletin DMO13. 6-page illustrated bulletin describing this company's thermometers and automatic temperature controllers. Bulletin OP1502. Folder describing a machine-running time recorder giving principles of operation and methods of use.

Instruments. Brown Instrument Co., Philadelphia 44, Pa.—Catalog 5102. 20-page catalog featuring the radiomatic pyrometers made by this company. The theory and principles of radiation pyrometry are discussed and construction data, specifications, together with application and operating information are given.

Instruments. Nilsson Electrical Laboratory, Inc., 103 Lafayette St., New York 13, N. Y.—18-page booklet illustrating and describing the instrument factory, service and repair facilities of this company.

Insulation. Baldwin Hill Co., Trenton, N. J.—28-page industrial catalog describing the various high and low temperature mineral wool insulations made by this company. Applications, specifications, conductivity curves and engineering data are included.

Line Blinds. Hamer Oil Tool Co., 2919 Gardenia Avenue, Long Beach 7, Calif.—12-page catalog giving design features, specifications and operating performance of this firm's line blinds. Includes photographic reproductions and diagrammatic sketches of each type.

Magnetic Separators. Dings Magnetic Separator Co., 509 E. Smith St., Milwaukee 7, Wis.—Catalog No. 260. 32-page illustrated catalog describing the uses of magnetic pulleys and pulley type separators in a number of different industries. Contains information on selection of equipment and includes tables of capacities, dimensions and specifications of this equipment.

Manganese Steel. American Manganese Steel Division, Chicago Heights, Ill.—Bulletin No. 114NM. 32-page booklet describing non-magnetic applications for Amsco manganese steel. Description of the various properties of this metal are discussed together with a large number of industrial applications.

Materials Handling. Towmotor Corp., Cleveland 10, Ohio—36-page pocket size booklet discussing the analysis of materials handling problems.

Ovens. Gehnrich Oven Division, W. S. Rockwell Co., 108 Jewell St., Brooklyn 22, N. Y.—Catalog No. 116. 4-page illustrated folder de-

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scribing the construction of ovens made by this company. Various types of heat distribution methods are illustrated and described.

Packing. Greene, Tweed & Co., Bronx Blvd. and 238th St., New York 66, N. Y.—Bulletin P3. 12-page pocket size folder describing Palmetto packing and giving information on the selection of packing for specific fluids, equipment and types of service.

Pumps. The Deming Co., Salem, Ohio—20-page booklet entitled "Facts You Should Know About Centrifugal Pumps and Impellers." This booklet contains basic information and is designed to assist in the selection and application of standard types of centrifugal pumps.

Pumps. Economy Pumps, Inc., Hamilton, Ohio—416-page pump engineering data book covering the principles of pump engineering and other related engineering data and includes selection and application data.

Pumps. Pacific Pump Works, Huntington Park, Calif.—A series of 10 publications giving performance data and outstanding features of design of this concern's complete line of centrifugal, hot oil and other types of pumps. Illustrated with photographic reproductions and drawings of equipment.

Pumps. Robbins and Meyers, Inc., Springfield, Ohio—Book No. 20. 16-page booklet illustrating and describing this company's helical rotor, positive, self priming pump. Claimed to be able to handle anything from freeflowing liquids to nonpourable pastes this type of pump has many applications. Sizes, ratings, specifications and performance data are given.

Pumps. Warren Steam Pump Co., Inc., Warren, Mass.—Bulletin 239. 4-page illustrated folder describing the Warren horizontal duplex plunger pump for boiler feed and pressure service.

Pumps. Worthington Pump & Machinery Corp., Harrison, N. J.—4-page folder describing steam jacketed rotary pumps for melted materials or highly viscose liquids requiring preheating. Bulletin W-487-B11.

Pumps. Yeomans Bros. Co., 1433 No. Dayton St., Chicago 22, Ill.—Bulletin 1011. 4-page folder illustrating and describing the horizontal centrifugal pumps for various applications.

Refrigeration. Worthington Pump & Machinery Corp., Harrison, N. J.—Bulletin C-1100-B21 describing gas engine refrigeration compressors. Bulletin C-1100-B22 describing steam engine driven horizontal double acting refrigeration compressors. Bulletin C-1100-B23 describing booster refrigeration compressors. Bulletins C-1100-S46, S49, S50, S52, S53, S55, S57, S59, S60 and S61. Ten leaflets illustrating and describing various refrigeration units using Freon 12.

Safety Appliances. Mine Safety Appliances Co., Pittsburgh, Pa.—Leaflet describing salt tablet dispensers for use wherever hot working conditions are encountered.

Steam Platens. Luckens Steel Co., Coatesville, Pa.—4-page illustrated leaflet describing features of the steam platens made by this company. Advantages are said to be more uniform surface temperature, more rapid heat transfer, longer life expectancy, and other similar qualities.

Synthetic Rubber. Hycar Chemical Co., 325 So. Main St., Akron, Ohio—20-page illustrated booklet describing this company's special purpose synthetic rubbers and their industrial uses. Properties and applications of vulcanized compounds are included together with tables of properties.

Thermocompressors. Worthington Pump & Machinery Corp., Harrison, N. J.—Bulletin RP-269. 8-page reprint entitled "Steam Jet Thermocompressors Supply Intermediate Pressure Processes."

Vacuum Pumps. F. J. Stokes Machine Co., Philadelphia 20, Pa.—Bulletin No. 463. 4-page illustrated folder describing features and applications of the Microvac high vacuum pumps made by this company.

Water Treatment. Calgon, Inc., Hagan Building, Pittsburgh 30, Pa.—16-page booklet giving general data on Calgon and its uses in washing, scouring, bleaching, dyeing and other applications in the textile industry.

Water Treatment. D. W. Haering & Co., Inc., Chicago, Ill.—Booklet describing the correction of corrosion problems on equipment used in the manufacture of synthetic dyestuffs.

Zinc Sulphate. The Chemical and Pigment Co., Oakland, Calif.—4 page folder giving formulation and application data of this firm's agricultural grade zinc sulphate for citrus and deciduous fruit and for zinc deficiency diseases of vine crops.

CHEMICAL ECONOMICS

H. M. BATTERS, Market Editor

MOVEMENT OF INDUSTRIAL CHEMICALS WELL SUSTAINED WITH LITTLE CHANGE ANTICIPATED

WHILE THERE was a rather sharp drop in the indexes for general business in June, the decline did not run throughout industry as some branches either equalled or surpassed their showing in the preceding month. The Federal Reserve Board index for chemicals stood at 317 for both May and June but its index for industrial chemicals was 412 for June, indicating a five-point rise over the May number. The lowering in the general indexes may be attributed partly to closing of some plants which had been engaged in war work and partly to the slowing up in some outputs due to the interruptions incidental to reconversion.

In the chemical industry, there undoubtedly has been some reduction in operations at government-owned plants. Furthermore it is evident that future production will not reach the heights which had been expected some time ago. One proof of this is found in the announcement that work has been halted at the plant which was to produce toluene at Borger, Tex. Considerable work had been done on the plant but evidently its completion would not be warranted in view of the present position of the chemical supply. Incidentally it may mean that new types of bombs in which TNT is not required, may play a more important part in future action.

Industries which consume industrial chemicals in a large way do not appear to have made any changes in their operating schedules. Daily rates for June were about the same as in preceding months. The *Chem. & Met.* index for consumption of chemicals dropped to 188.51 in June from the high point of 192.90 reached in May. Last year the comparable index numbers were 189.42 and 185.29 respectively.

Production data for the individual chemicals, with few exceptions, show a smaller total for June than was reported for May. Difference in working hours accounts for the drop in most cases. Some chemicals, particularly metal salts are now being turned out in larger volume than they were a few months ago, this being due to the release of more metal for such use. In some cases stocks of chemicals have increased and this has made it unnecessary to push production.

Because it consumes chemicals in such a large way, the fertilizer industry has a stabilizing effect on total industrial chemical consumption. Superphosphate production, for instance, formerly was of a highly seasonal nature with a marked falling off in operations during the summer months. At present, demand for superphosphate has grown to a point where producers are able to keep plants on a fairly even rate of operation throughout the year. Production of superphosphate in June actually was higher than it was in May which shows the extent to which the former trend has been eliminated.

Carbon black production has made so much progress that it is now much in line with requirements. At the end of July, WPB estimated production for that month at 102.8 million pounds or nearly one and a half million pounds above estimated needs. Requirements for the third quarter of this year are placed at 312 million pounds and the projection for production is one million pounds under that figure. However, all types of black are not available in wanted volume and it still is necessary for consumers to make the best possible use of substitute types.

While permission to convert to civilian-goods production and allocations of materials for that purpose, are on the increase, this does not mean that industrial consumption of chemicals will increase to an equal degree. Many of the regular producing lines are turning over a large part of their production to the armed forces and a greater part of this can be made available for civilian use without changing total volume of output. Some idea of the outlook for the flow of chemicals into direct war products may be inferred from a WPB report which stated that in spite of large munitions reductions as the nation shifted to a one-war basis, output in July was still about 85 percent of the rate attained at the year's peak last March. In discussing war production schedules for the last six months of this year, the Board stated that by the end of August the nation's factories will be producing for war at about 80 percent of the March rate. By December the projected rate will be about 70 percent of the March rate.

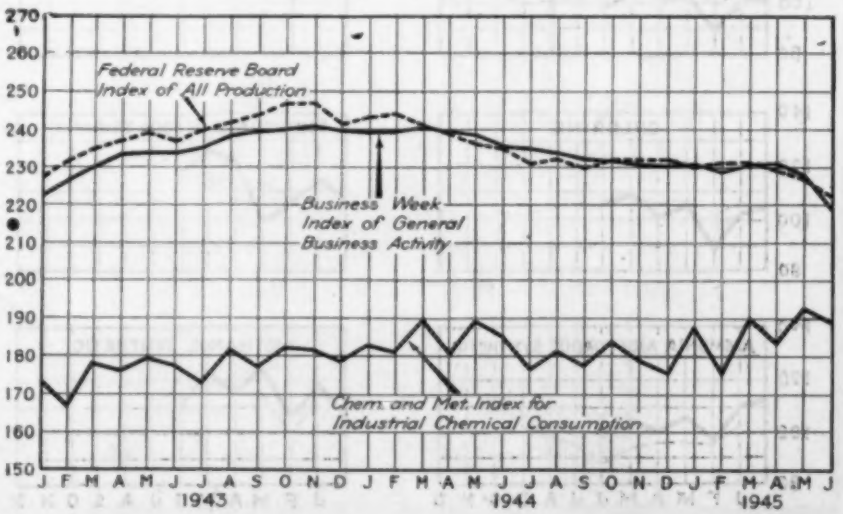
While many chemicals remain in small supply, the recent trend has been toward a more equitable balance between supply and demand and even toward some accumulations. This condition has been found in many lines, for a study made by the Department of Commerce finds a significant shift in the trend of inventories. For over a year, manufacturers engaged in war work have been liquidating their raw materials and goods in process stocks. This liquidation was halted in recent months.

Further reduction in inventories of war goods accompanying contract cancellations will be more than offset by the building up of inventories of civilian goods, including the transfer of war inventories to civilian use, according to the Department experts. Thus in the second half of this year the value of business inventories is expected to increase on a net basis by one-half billion dollars and the accumulation is expected to be more rapid in 1946.

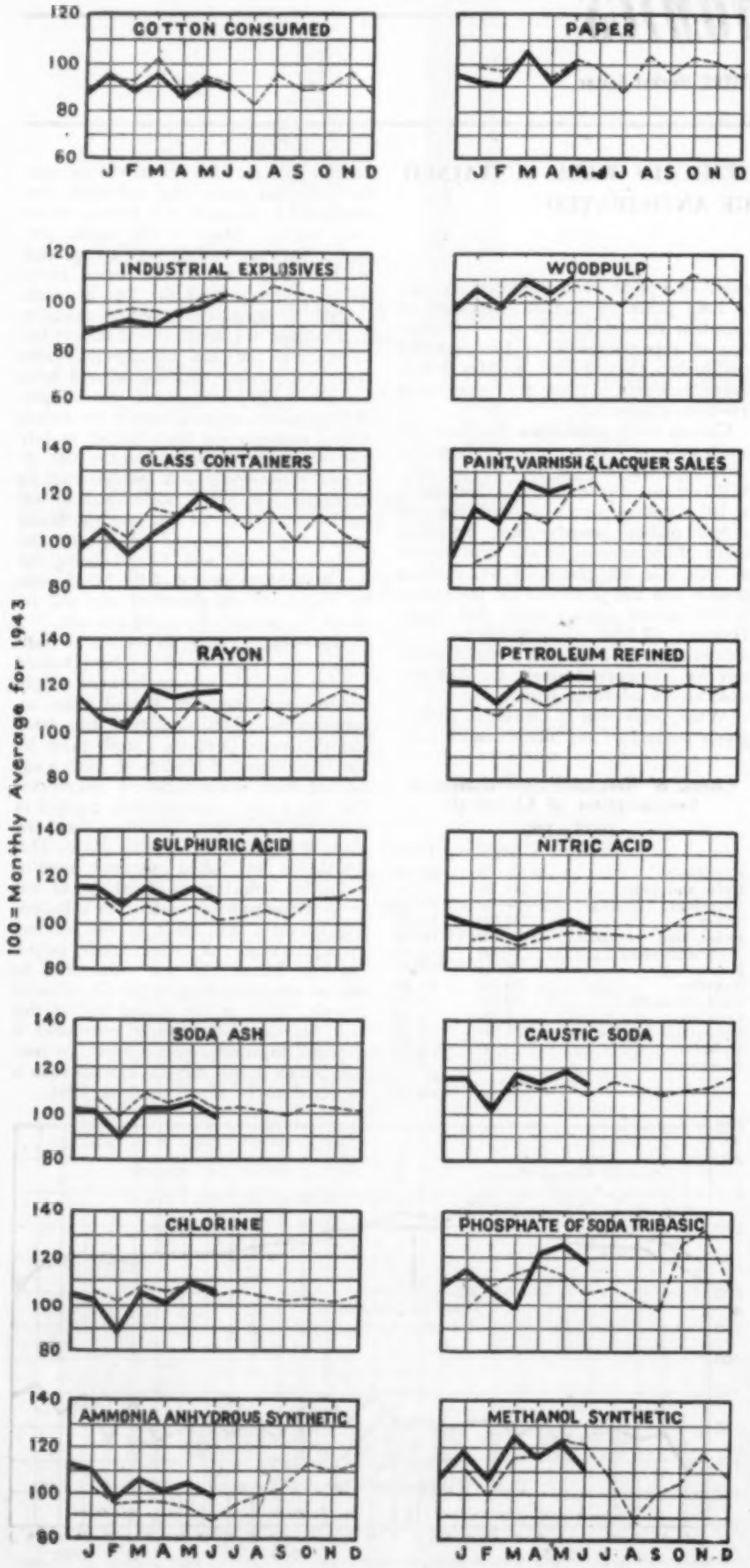
Chem. & Met. Index for Industrial Consumption of Chemicals

1935=100

	May	June
Fertilizers	41.79	42.17
Pulp and paper	20.20	19.20
Petroleum refining	19.70	19.26
Glass	20.29	19.03
Paint and varnish	19.42	18.90
Iron and steel	13.40	12.43
Rayon	18.74	18.87
Textiles	10.93	10.48
Coal products	10.33	9.95
Leather	5.40	5.67
Industrial explosives	5.50	5.67
Rubber	3.00	3.00
Plastics	5.10	5.00
	192.90	188.51



PRODUCTION AND CONSUMPTION TRENDS



With the possibility of an improvement in shipping conditions, there has been more of a tendency to look to outside sources as a means of overcoming the scarcities in raw material supplies. So far there have been no very tangible results from efforts made to increase importations of vegetable oils and oilseeds. Soap makers have been interested in information regarding the status of the copra trade in the Philippines. Recent reports say fairly large stocks of copra have been collected but can not be shipped because of lack of tonnage. Difficulties in shipping may lead to more extensive crushing on the islands which ultimately might mean that the islands would become more important shippers of oil than of copra.

One of the major problems in supplying fats and oils for the soap industry is caused by the huge new demand for industrial soaps. In prewar years 75 million pounds of fats made enough soap for all industrial users, including those for makers of textiles, wire drawing, etc. By 1943 it took 140 million pounds, last year 180 million pounds and now nearly three times the prewar average.

Pulp and paper interests also have been closely following reports on what may be expected in the way of obtaining pulp from northern Europe. The movement from Sweden already has started and probably will continue until the stocks in that country have been depleted. The advisory committee was informed last month that Sweden's main difficulty was shortage of coal which makes it necessary to use more wood for fuel. Usually only 7 to 10 percent of Sweden's wood production is used for fuel but last year 43 percent of the production was so used and at present the coal outlook is so unfavorable that it may be necessary to substitute wood to a greater degree than was the case last year.

Peak demand for ethyl alcohol has passed and there have been steady declines in the estimated requirements as projected from time to time. Latest figure places 1945 needs at 528,000,000 gal. This is broken down as 62 million for direct military and lend-lease, 259 million for synthetic rubber, 171 million for indirect military and civilian, and 36 million for anti-freeze. The largest drop from the estimate as of June is found in requirements for synthetic rubber and this not only implies that more butadiene is coming from petroleum but also may indicate that as petroleum supplies become more readily available, demand for alcohol will decline in a corresponding way.

Last year production of calcium arsenate was cut down because large carryover stocks were on hand from the previous season. The recent spell of rainy weather has been extended to the cotton belt and early in August reports of heavy boll weevil damage to the growing cotton crop came from different sections. This brought out a more active call for arsenate but supplies available in the infected areas were not large and different agencies have cooperated to speed up delivery of different chemical products to southern points.

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United States Production of Certain Chemicals

May 1945, May 1944 and Five-Month Totals for 1945 and 1944

Chemical and Basis	Units	May 1945	May 1944	Total, First 5 Months 1945	Total, First 5 Months 1944
Aluminum chloride:					
Anhydrous & crystal (100% $AlCl_3$)	M lb.	5,401	.....	25,686	.....
Solution (32° Be)	M lb.	1,022	.....	5,229	.....
Ammonia, synthetic anhydrous (100% NH_3)[1]	Tons	48,244	42,308	227,633	218,191
Ammonium chloride (100% NH_4Cl)	M lb.	6,020	.....	27,101	.....
Barium sulphate (100% $BaSO_4$)	M lb.	5,422	.....	24,388	.....
Bleaching powder (35–37% avail. Cl_2)	M lb.	2,708	3,747	12,179	27,568
Calcium acetate (80% $Ca(C_2H_3O_2)_2$)	M lb.	829	1,083	3,176	5,151
Calcium arsenate (100% $Ca_3(AsO_4)_2$)	M lb.	2,403	4,890	10,065	18,879
Calcium hypochlorite (70% avail. Cl_2)	M lb.	1,439	1,261	6,510	6,006
Calcium phosphate: monobasic (100% $CaH_4(PO_4)_2$)	M lb.	5,210	4,270	25,992	25,118
Dibasic (100% $CaHPO_4$)	M lb.	3,389	.....	18,318	.....
Carbon, activated	M lb.	5,671	.....	25,597	.....
Carbon black (channel): rubber grade	M lb.	41,498	.....	186,613	.....
Other grades	M lb.	2,878	.....	13,036	.....
Chlorine	Tons	110,746	109,337	517,709	532,323
Chrome green (C.P.)	M lb.	419	570	2,543	2,632
Chrome yellow & orange (C.P.)	M lb.	3,382	.....	16,878	.....
Hydrochloric acid (100% HCl)	Tons	37,152	30,940	181,214	147,725
Hydrogen peroxide (100 volumes)	M lb.	2,738	.....	13,428	.....
Iron blue	M lb.	822	.....	3,973	.....
Lamp black	M lb.	1,406	.....	5,959	.....
Lead oxide: red (C.P.)	M lb.	7,717	9,390	50,780	45,203
Yellow (C.P.)	M lb.	27,584	.....	140,459	.....
Methanol: natural (80% CH_3OH)	M gal.	341	384	1,844	1,790
Synthetic (100% CH_3OH)	M gal.	6,715	6,494	32,166	30,710
Molybdate chrome orange (C.P.)	M lb.	151	105	652	632
Nitric acid (100% HNO_3)	Tons	41,757	38,968	200,716	189,412
Phosphoric acid (50% H_3PO_4)	Tons	59,091	59,147	274,541	309,328
Potassium bichromate & chromate (100%)	M lb.	688	733	3,045	3,524
Potassium hydroxide (100% KOH)	Tons	4,586	3,736	21,907	18,166
Soda ash (commercial sodium carbonate):					
Ammonia-soda process (98–100% Na_2CO_3):					
Total wet & dry[2]	Tons	388,044	393,933	1,844,470	1,936,155
Finished light[2]	Tons	206,019	212,240	982,134	1,060,506
Finished dense	Tons	125,907	126,642	576,322	612,502
Sodium bicarbonate (100% $NaHCO_3$)	Tons	16,393	13,077	71,536	66,229
Sodium bichromate & chromate	Tons	6,955	7,060	34,264	35,608
Sodium bisulphite (100% $NaHSO_3$)	M lb.	3,263	.....	15,915	.....
Sodium hydrosulphide (100% NaSH)	M lb.	2,414	.....	9,924	.....

(Table continued on p. 244)

Data for this tabulation have been taken from "Facts for Industry" series issued by Bureau of the Census and WPB Chemicals Bureau. Production figures represent primary production and do not include purchased or transferred material. Quantities produced by government-owned arsenals, ordnance works, and certain plants operated for the government by private industry not included. Chemicals manufactured by TVA, however, are included. All tons are 2,000 lb. Where no figures are given, data are either confidential or not yet available. [1] Includes a small amount of aqua ammonia. [2] Total wet and dry production including quantities diverted for manufacture of sodium bicarbonate and caustic soda and quantities processed to finished light and finished dense. [3] Not including quantities converted to finished dense. Data collected in cooperation with the Bureau of Mines. [5] Figures represent total production of liquid material, including quantities evaporated to solid caustic and reported as such. [6] Include oleum grades. Excludes spent acid.

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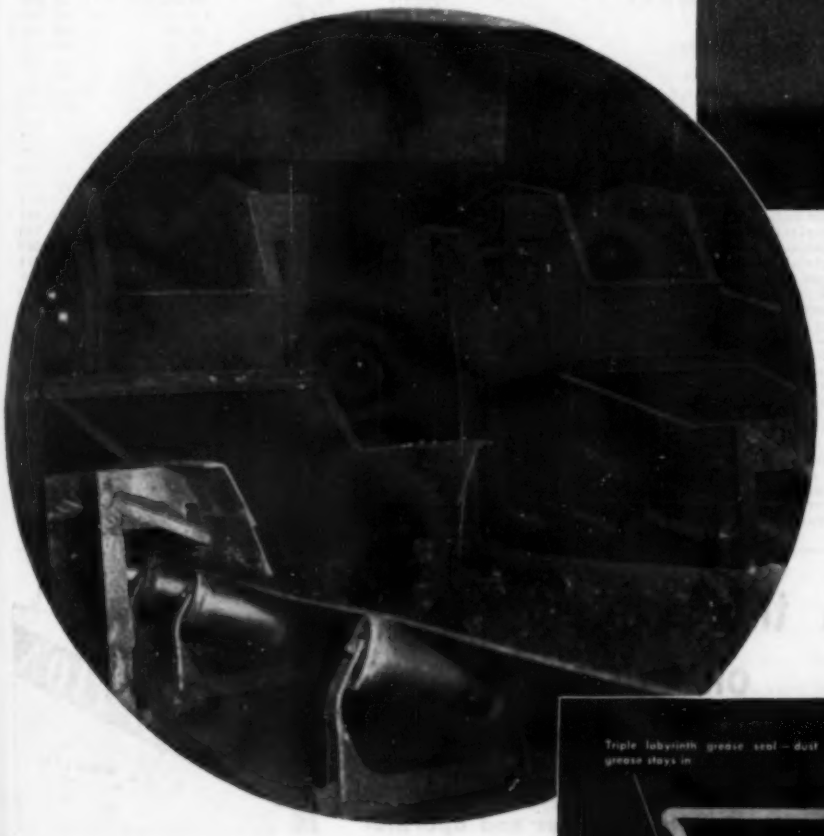

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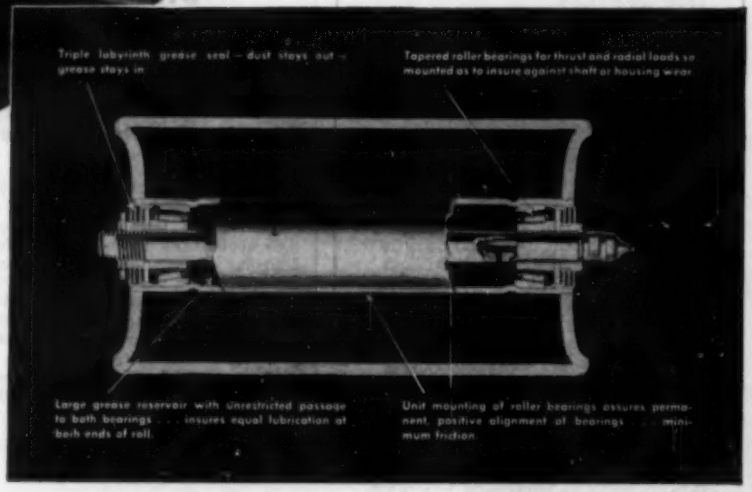

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U. S. Chemical Production (Cont. from p. 242)

Sodium hydrosulphite (100% $Na_2S_2O_4$)	M lb.	3,084	.....	15,924	.....
Sodium hydroxide (100% NaOH): electrolytic process[4]:					
Liquid	Tons	103,575	100,553	488,303	495,852
Solid	Tons	18,299	.....	93,701	.....
Lime-soda process:					
Liquid	Tons	65,315	57,733	316,685	294,100
Solid	Tons	21,995	.....	101,028	.....
Sodium silicate (anhydrous)	Tons	43,955	.....	189,828	.....
Sulphuric acid (100% H_2SO_4): chamber process	Tons	269,394	272,128	1,381,492	1,381,947
Net contact process[4]	Tons	507,590	422,141	2,405,681	2,152,622
White lead: basic lead carbonate[9]	Tons	3,282	.....	16,896	.....
Basic lead sulphate	Tons	1,080	.....	4,844	.....
Zinc yellow (zinc chromate) (C.P.)	Tons	1,273	.....	8,263	.....

United States Production of Certain Synthetic Organic Chemicals

May 1945, May 1944 and Five-Month Totals for 1945 and 1944

Item	May 1945	May 1944	Total, First 5 Months 1945	Total, First 5 Months 1944
Acetanilide, technical and U. S. P.	719,711	367,342	*2,458,486	2,748,783
Acetic acid, synthetic[1]	24,469,552	25,185,075	118,528,647	126,446,195
Acetic acid, natural[2]	3,039,355	3,478,309	14,937,792	17,066,685
Acetylsalicylic acid, aspirin	924,877	819,287	4,499,772	3,843,225
n-Butyl acetate	6,131,244	5,757,102	30,638,430	31,836,453
Creosote oil, tar distillers[3]	12,899,688	10,408,347	56,612,024	55,451,717
Creosote oil, byproduct[4, 5]	3,173,432	3,590,622	15,845,719	16,338,876
Cresols, meta-para[6]	1,036,179	690,558	3,599,710	3,079,776
Cresols, ortho-meta-para[6]	806,062	861,568	*3,222,604	3,831,664
Cresylic acid, crude	2,285,983	2,010,530	11,340,931	10,369,971
Cresylic acid, refined[6]	2,273,115	3,752,406	12,987,909	17,334,137
Diethyl ether	9,199,426	5,479,990	40,308,581	25,696,478
Ethyl acetate	9,929,117	8,213,741	47,139,363	44,996,096
Lactic acid, edible	496,067	368,974	2,097,342	1,771,573
Lactic acid, technical	367,526	238,526	2,062,265	1,379,846
Methyl chloride, all grades	2,473,330	1,936,596	12,377,125	8,672,765
Naphthalene, coke-oven operators[4, 7]	7,579,986	9,094,765	37,759,521	44,555,682
Naphthalene, tar distillers[7, 8]	17,570,935	15,368,563	84,312,190	80,815,671
Naphthalene, refined[8]	6,212,199	7,076,885	28,852,165	37,872,722
Oxalic acid, technical	1,783,564	1,550,033	8,514,773	7,373,440
Phthalic anhydride	12,330,106	10,713,573	55,213,008	50,847,534
Sulfa drugs, total[10]	595,903	336,835	2,333,436	2,806,091

Statistics collected and compiled by the U. S. Tariff Commission except where noted. In pounds except that creosote oil is expressed in gallons. [1] Excludes, recovered acetic acid. [2] Acetic acid produced by direct process from wood and from calcium acetate. Compiled by Bureau of Census. [3] Product of distillers of purchased tar only. [4] Product of byproduct coke-oven operators only. [5] Statistics collected and compiled by Coal Economics Division, U. S. Bureau of Mines. [6] Statistics reported by byproduct coke-oven operators combined with those reported by tar distillers to prevent disclosure of operations of individual companies. [7] Statistics combine three grades: sodifying at less than 74; 74 to less than 76; and 76 to less than 79 deg. C. [8] Production for sale only in case of less than 74 grade. Production both for consumption within producing plant and for sale in case of other two grades. [9] 79 deg. C. and over. [10] Includes data for acetylsulfathiazole, both as drug and as intermediate, resulting in appreciable duplication. * Four-month total, figures for one month were confidential.

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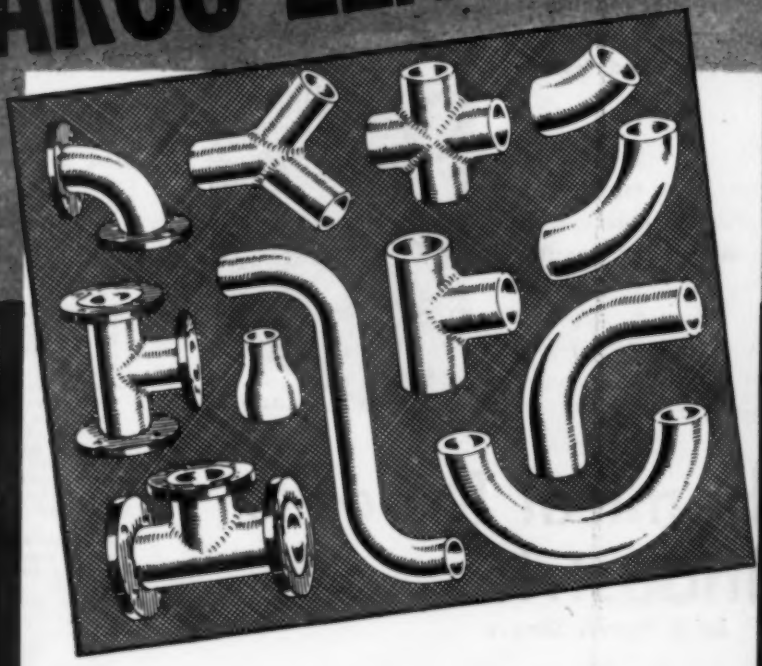

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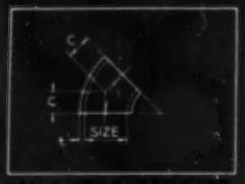

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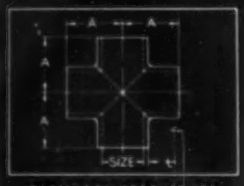

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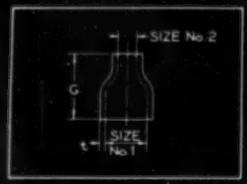

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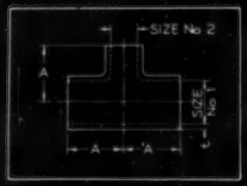
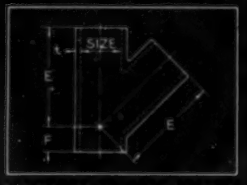


LEAD REDUCING TEE



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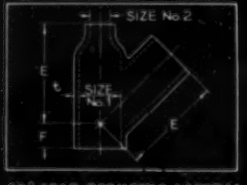
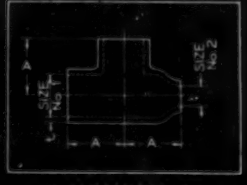


45° LEAD REDUCING LATERAL



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Base = 100 for 1937

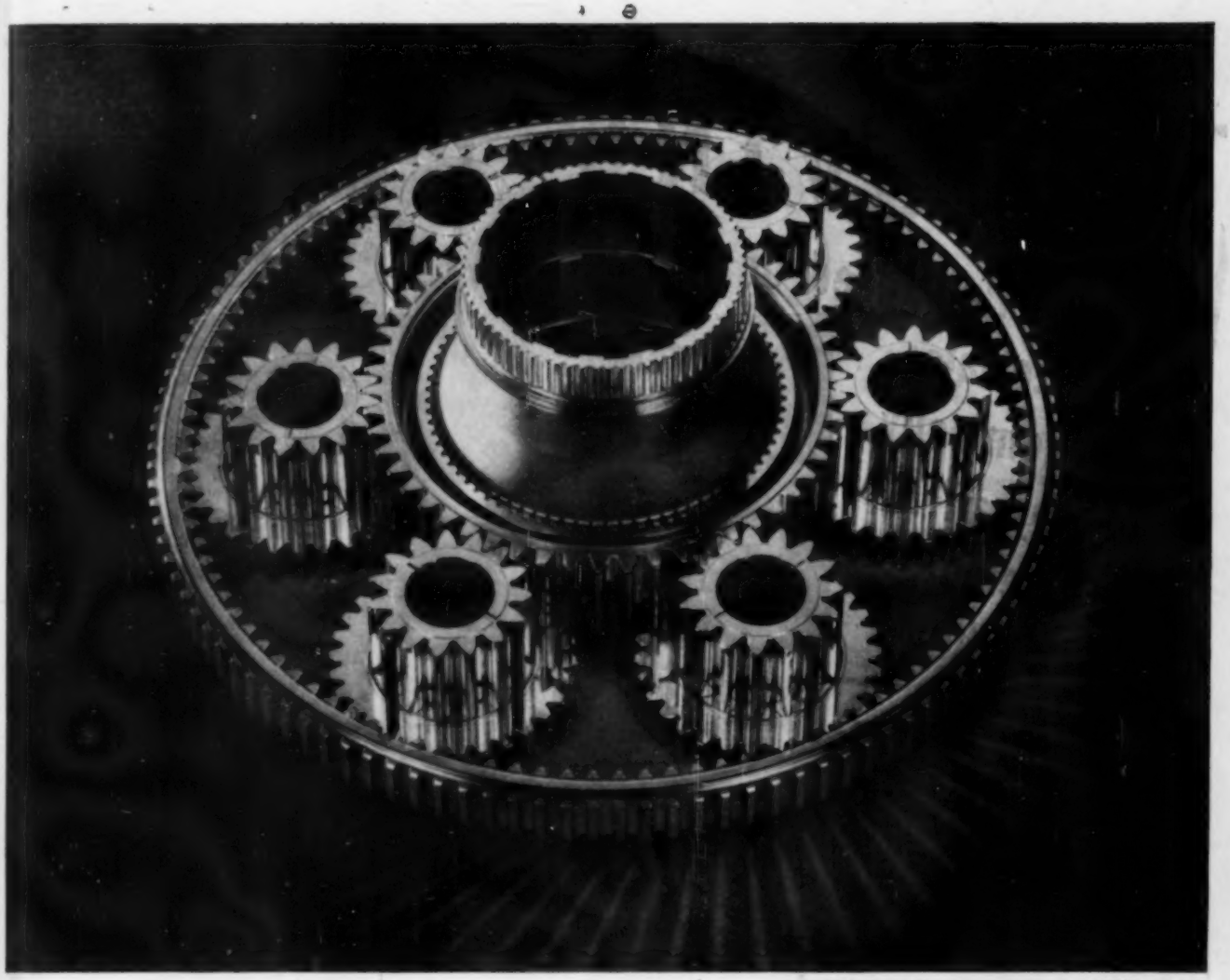
This month	**108.75**
Last month	108.70
August, 1944	109.48
August, 1943	109.03

CURRENT PRICES

The accompanying prices refer to round lots. Where, it is trade custom to sell f.o.b. works, quotations are so designated. Prices are corrected to August 13.

INDUSTRIAL CHEMICALS

Acetone, tanks, lb.	$0.06 –
Acid, acetic, 28%, bbl., 100 lb.	3.38 – $3.63
Boric, bbl., ton	109.00 –113.00
Citric, kegs, lb.	.20 – .23
Formic, cbys., lb.	.10½– .11
Hydrofluoric, 30%, drums, lb.	.08 – .085
Lactic, 44%, tech. light, bbl., lb.	.073– .075
Muriatic, 18°, tanks, 100 lb.	1.05 –
Nitric, 36°, carboys, lb.	.05 – .05½
Oleum, tanks, wks., ton	18.50 – 20.00
Oxalic, crystals, bbl., lb.	.11½– .12½
Phosphoric tech., tanks, lb.	.04 –
Sulphuric, 60°, tanks, ton	13.00 –
Tartaric, powd., bbl., lb.	.70½
Alcohol, amyl	–
From pentane, tanks, lb.	.13½–
Alcohol, butyl, tanks, lb.	.10½– .18½
Alcohol, ethyl, denatured, 190 proof	–
No. 1 special, tanks, gal., wks.	.50 –
Alum, ammonia, lump, lb.	.04½–
Aluminum sulphate, com. bags 100 lb.	1.15 – 1.40
Ammonia, anhydrous, cyl., lb.	.14½–
tanks, ton	59.00 – 60.00
Ammonium carbonate, powd., tech., casks, lb.	.09½– .12
Sulphate, wks., ton	28.20 –
Amyl acetate, tech., from pentane, tanks, lb.	.145–
Aqua, ammonia, 26°, drums, lb.	.02½– .03
tanks, ton	65.00 –
Arsenic, white, powd., bbl., lb.	.04 – .04½
Barium, carbonate, bbl., ton	65.00 – 75.00
Chloride, bbl., ton	75.00 – 78.00
Nitrate, casks, lb.	.09½– .11
Blanc fix, dry, bags, ton	60.00 – 70.00
Bleaching powder, f.o.b., wks., drums, 100 lb.	2.50 – 3.00
Borax, gran., bags, ton	45.00 –
Calcium acetate, bags, 100 lb.	3.00 –
Arsenate, dr., lb.	.07½– .08
Carbide, drums, ton	50.00 –
Chloride, flake, bags, del., ton	18.50 – 25.00
Carbon bisulphide, drums, lb.	.05 – .05½
Tetrachloride, drums, gal.	.73 – .80
Chlorine, liquid, tanks, wks., 100 lb.	1.75 – 2.00
Copperas, bgs., f.o.b., wks., ton	17.00 – 18.00
Copper carbonate, bbl., lb.	.19½– .20
Sulphate, bbl., 100 lb.	5.00 – 5.50
Cream of tartar, bbl., lb.	.57 –
Diethylene glycol, dr., lb.	.14½– .15½
Epsom salt, dom., tech., bbl., 100 lb.	1.80 – 2.00
Ethyl acetate, tanks, lb.	.11½–
Formaldehyde, 40%, tanks, lb.	.032–
Furfural, tanks, lb.	.09½–
Glaubers salt, bags, 100 lb.	1.05 – 1.10
Glycerine, c.p., drums, extra, lb.	.17½– .17½
Lead:	
White, basic carbonate, dry, casks, lb.	.08½–
Red, dry, sck., lb.	.09 –
Lead acetate, white crys., bbl., lb.	.12½– .13
Lead acetate, powd., bag, lb.	.11½– .12
Lithopone, bags, lb.	.04½– .04½
Magnesium carb., tech., bags, lb.	.06½– .06½
Methanol, 95%, tanks, gal.	.58 –
Synthetic, tanks, gal.	.24 –
Phosphorus, yellow, cases, lb.	.23 – .25
Potassium bichromate, casks, lb.	.10½– .10½
Chlorate, powd., lb.	.09½– .12
Hydroxide (c'stic potash) dr., lb.	.07 – .07½
Muriate, 60%, bags, unit	.53½–
Nitrate, bbl., lb.	.05½– .06
Permanganate, drums, lb.	.19½– .20
Prussiate, yellow, casks, lb.	.16 – .17
Sal ammoniac, white, casks, lb.	.0515– .06
Salsoda, bbl., 100 lb.	1.00 – 1.05
Salt cake, bulk, ton	15.00 –
Soda ash, light, 58%, bags, contract, 100 lb.	1.05 –
Dense, bags, 100 lb.	1.15 –
Soda, caustic, 76% solid, drums, 100 lb.	2.30 – 3.00
Acetate, del., bbl., lb.	.05 – .06
Bicarbonate, bbl., 100 lb.	1.70 – 2.00
Bichromate, casks, lb.	.07½– .08½
Bisulphate, bulk, ton	16.00 – 17.00
Bisulphite, bbl., lb.	.03 – .04



Here's the heart of a mighty engine

You are looking at the transmission of a giant aircraft engine. Delicate as these gears seem, they possess the tough strength and endurance to carry a mighty bomber on its thousand mile mission—and back—time after time. This dramatic coupling of rugged strength and light weight—of mighty power and compactness is made possible by new gear production methods developed by Foote Bros.

The big miracles these revolutionary type gears perform are due to the extremely close tolerances to which every dimension is held—to the unique developments in heat-treating that assure the proper hardness of every part—to the extraordinary control of every step in production that permits their manufacture in quantities even though specifications demand laboratory precision.

These new A-Q (Aircraft Quality) gears are already suggesting revolutionary changes in many peacetime machines. They are permitting smaller, more compact design—they are making possible greatly increased operating speeds—they are assuring longer life to machines and equipment on which they are used.

Designers and production engineers interested in the possibilities of these new gears will find complete data on them in a bulletin recently issued by Foote Bros. Write for a copy of Bulletin A-Q-A. It will be sent to you upon request.

* * *

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This engineering bulletin on A-Q gears gives complete engineering data, comparative performance curves, design details and other information on this revolutionary type gearing.

FOOTE BROS.

Better Power Transmission Through Better Gears

CHEM. & MET. Weighted Index of Prices for OILS & FATS

Base = 100 for 1937

This month	145.85
Last month	145.85
August, 1944	145.24
August, 1943	145.55

Chlorate, kegs, lb	$0.06½	$0.06½
Cyanide, cases, dom., lb	.14½	.15
Fluoride, bbl., lb	.07	.08
Hyposulphite, bbl., 100 lb	2.40	2.50
Metasilicate, bbl., 100 lb	2.50	2.65
Nitrate, bulk, 100 lb	1.35	
Nitrite, casks, lb	.0	.07
Phosphate, tribasic, bags, lb	2.70	
Prussiate, yel., bags, lb	.0	.10
Silicate, 40°, dr., wks., 100 lb	.80	.85
Sulphide, bbl., lb	.02½	
Sulphite, crys., bbl., lb	.02½	.02½
Sulphur, crude at mine, long ton	16.00	
Dioxide, cyl., lb	.07	.08
Dioxide, tanks, lb	.04	
Tin crystals, bbl., lb	.39½	
Zinc chloride, gran., bbl., lb	.05½	.06
Oxide, lead free, bag, lb	.07	
Oxide, 5% leaded, bags, lb	.07	
Sulphate, bbl., cwt.	3.85	4.00

OILS AND FATS

Castor oil, No. 3 bbl., lb	$0.13½	$0.14½
Chinawood oil, tanks, lb	.38½	
Coconut oil, ceylon, dr. N. Y., lb	.0885	
Corn oil crude, tanks (f.o.b. mill), lb	.12½	
Cottonseed oil, crude (f.o.b. mill), tanks, lb	.12½	
Linseed oil, raw, car lots, bbl., lb	.155	
Palm, casks, lb	.0865	
Peanut oil, crude, tanks (mill), lb	.13	
Rapeseed oil, refined, bbl., lb	nom.	
Soybean, tank, lb	.11½	
Menhaden, light pressed, dr., lb	.13	
Crude, tanks (f.o.b. factory) lb	.080	
Grease, yellow, loose, lb	.08½	
Oleo stearine, lb	.09	
Oleo oil, No. 1, lb	.11	
Red oil, distilled, bbl., lb	.12	
Tallow extra, loose, lb	.08½	

COAL-TAR PRODUCTS

Alpha-naphthol, crude, bbl., lb	$0.52	$0.55
Alpha-naphthylamine, bbl., lb	.32	.34
Aniline oil, drums, extra, lb	.15	.16
Aniline salts, bbl., lb	.22	.24
Benzaldehyde, USP, dr., lb	.85	.95
Benzidine base, bbl., lb	.70	.75
Benzoic acid, USP, kegs, lb	.54	.56
Benzol, 90%, tanks, works, gal	.15	
Benzyl chloride, tech., dr., lb	.23	.25
Beta-naphthol, tech., drums, lb	.23	.24
Cresol, USP, dr., lb	.11	
Cresylic acid, dr., wks., gal	.81	.83
Diphenyl, bbl., lb	.15	
Diethylaniline dr., lb	.40	.45
Dinitrotoluol, bbl., lb	.18	.19
Dinitrophenol, bbl., lb	.22	.23
Dip oil, 15%, dr., gal	.23	.25
Diphenylamine, dr., f.o.b. wks., lb	.60	
H acid, bbl., lb	.45	.50
Hydroquinone, bbl., lbp	.90	
Naphthalene, flake, bbl., lb	.07	.07½
Nitrobenzene, dr., lb	.08	.09
Para-cresol, bbl., lb	.41	
Para-nitraniline, bbl., lb	.47	.49
Phenol, USP, drums, lb	.10½	.11
Picric acid, bbl., lb	.35	.40
Pyridine, dr., gal	1.70	1.80
Resorcinol, tech., kegs, lb	.75	.80
Salicylic acid, tech., bbl., lb	.26	.33
Solvent naphtha, w.w., tanks, gal	.27	
Tolidone, bbl., lb	.96	.98
Toluol, drums, works, gal	.33	
Xylol, com., tanks, gal	.26	

MISCELLANEOUS

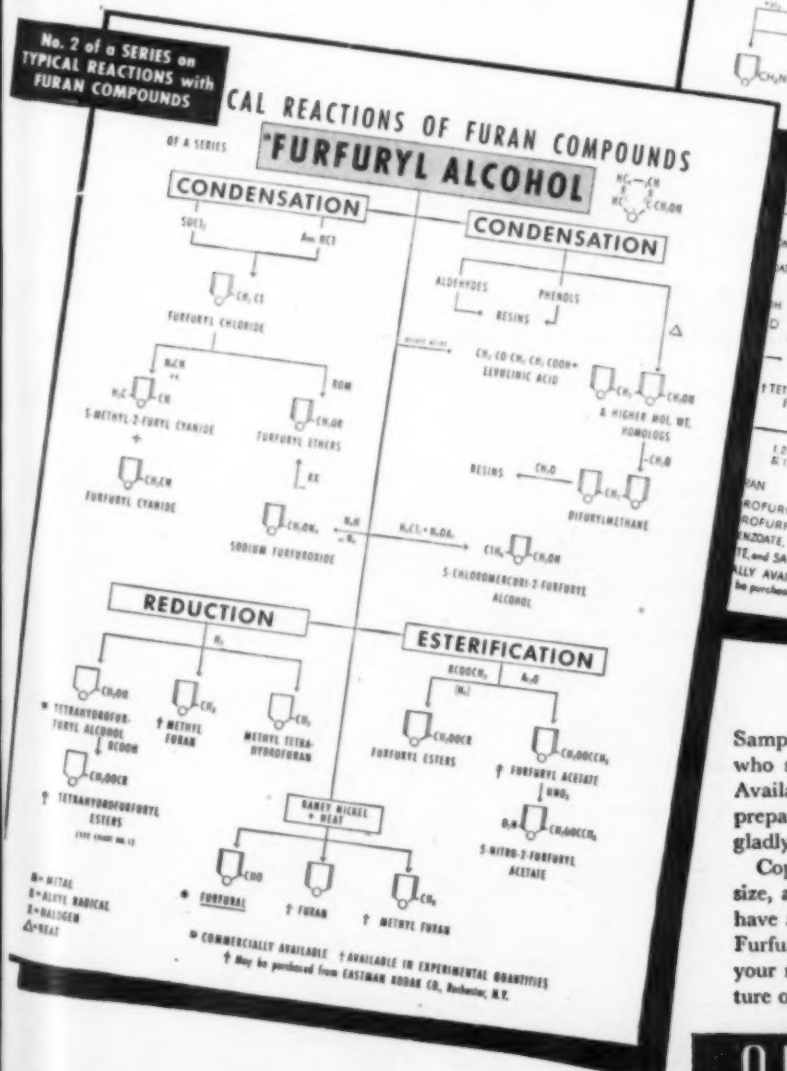
Casein, tech., bbl., lb	$0.21	$0.24
Dry colors		
Carbon gas, black (wks.), lb	.0335	.30
Prussian blue, bbl., lb	.36	.37
Ultramarine blue, bbl., lb	.11	.26
Chrome green, bbl., lb	.23	.33
Carmine, red, tins, lb	4.60	4.75
Para toner, lb	.75	.80
Vermilion, English, bbl., lb	2.50	2.60
Chrome, yellow, C.P., bbl., lb	.16	.17
Gum copal, Congo, bags, lb	.09	.55
Manila, bags, lb	.09	.15
Damar, Batavia, cases, lb	.10	.22
Kauri, cases, lb	.18	.60
Magnesite, calc, ton	64.00	
Pumice stone, lump, bbl., lb	.05	.07
Rosin, H., 100 lb	6.43	
Shellac, orange, fine, bags, lb	.39	
Bleached, bonedry, bags, lb	.39	
T. N. bags, lb	.31	
Turpentine, gal	.80	

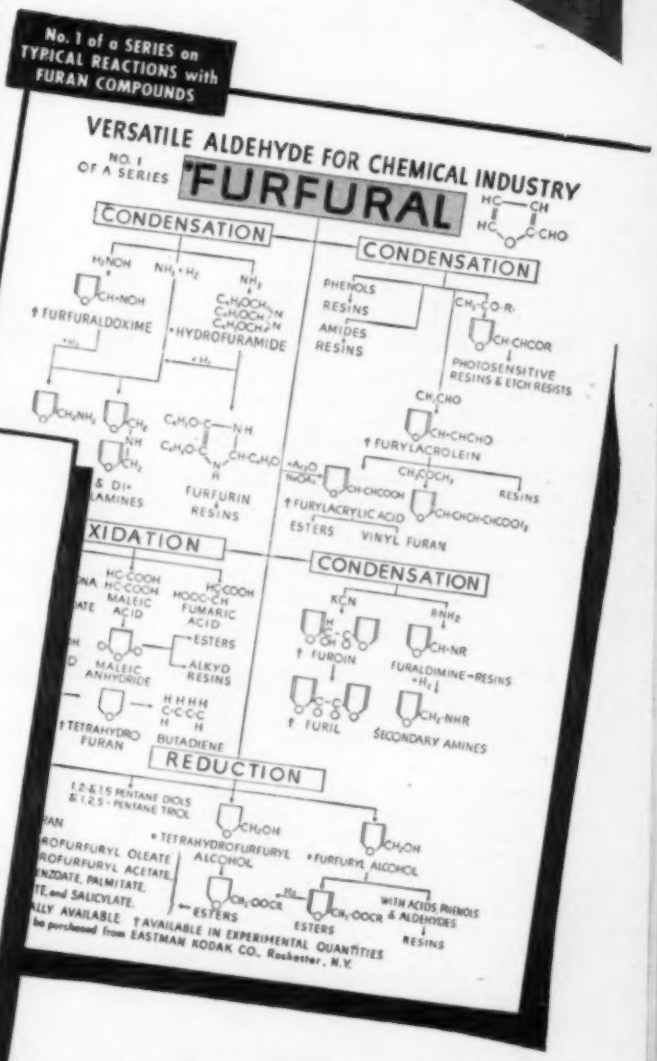
YOU CAN DO SO MANY THINGS WITH FURFURYL ALCOHOL DOES SO MANY THINGS FOR YOU

Here's a chemical with which you should become better acquainted. It is so versatile and its properties so diverse that it should be able to fit advantageously into your scheme of operations whatever they may be. Of especial interest is its extreme reactivity and the many things you can do with Furfuryl Alcohol. A few of the typical reactions with Furfuryl Alcohol are indicated on the chart. Products of these reactions that are commercially available are indicated by an asterisk.

Supply of Furfuryl Alcohol is plentiful and it is available in two grades, technical and refined.

Our Technical Staff is ready to help on the application of Furfuryl Alcohol and the other Furans to your problems.





Samples of products marked * or † are available for those who see in them a possible application to their problems. Available data and literature references on properties and preparations of those compounds not yet available will be gladly furnished.

Copies of this chart in file size, 8½" x 11", or wall chart size, approximately 18" x 24", available on request. We still have available a limited number of wall charts (18 x 24) on Furfural Reactions. If you have not yet sent for one, send in your request now. Please send requests for samples or literature on your company letterhead.

The Quaker Oats Company — **CHEMICALS DEPT.**

1940 BOARD OF TRADE BLDG., 141 W. JACKSON BLVD. • CHICAGO 4, ILL.

FURFURAL • FURFURYL ALCOHOL • HYDROFURAMIDE • TETRAHYDROFURFURYL ALCOHOL

NEW CONSTRUCTION

	Current Projects		Cumulative 1945	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	$450,000	$340,000	$3,410,000	$3,499,000
Middle Atlantic	380,000	80,000	5,702,000	16,122,000
South	2,340,000	182,000	21,678,000	23,025,000
Middle West	890,000	.....	11,539,000	25,006,000
West of Mississippi	2,520,000	942,000	60,992,000	83,404,000
Far West	87,000	84,000	4,832,000	7,941,000
Canada	405,000	320,000	9,174,000	2,681,000
Total	$7,072,000	$1,948,000	$117,327,000	$161,678,000

PROPOSED WORK

Ala., Mobile—Linde Air Products Co., 205 East 42nd St., New York, N. Y., plans to construct an acetylene plant here, S. R. Donnellon, c/o owner, Cons. Engr. Estimated cost $50,000.

Calif., San Jose—Bayshore Paper Co., 50 West St. John St., plans to construct a 1 story plant. Ralph Wyckoff, Anglo Bank Bldg., Archt. Estimated cost $40,000.

Ga., Atlanta—Sherwin-Williams Co., 1056 Murphy Ave., plans to construct a plant, warehouse and sales offices. Estimated cost $2,000,000.

Ia., Mason City—International Minerals & Chemical Corp., 61 Bway., New York, N. Y., plans to construct a fertilizer manufacturing plant here. Estimated cost $100,000.

Kan., Kansas City—Cities Service Gas Co., Oklahoma City, Okla., plans to construct 31 mi. of 20 in. domestic gas line in this area. Estimated cost $700,000.

Kan., Mullinville—Northern Natural Gas Co., Omaha, Neb., plans to construct a natural gas compressor station here. Estimated cost will exceed $100,000.

Kan., Welda—Cities Service Gas Co., Oklahoma City, Okla., plans expansions and improvements to its compressor station here. Estimated cost $200,000.

La., Belle Chasse—Niagara Sprayer & Chemical Co., Middleport, N. Y., plans to construct an 80x120 ft. plant here. N. J. Bedell Co., 504 Pan American Bldg., New Orleans, Engr.

La., Haynesville—J. R. Butler, Plant Mgr., plans to construct an addition to recycling and repressuring plant here. Two 800 hp. compressors will be added. Estimated cost $250,000.

Mass., Everett—Monsanto Chemical Co., 1700 South Second St., St. Louis, Mo., plans to construct a plant for the production of "Santocel", a chemical product, at its Merriman division plant here. Estimated cost $450,000.

O., Avon—B. F. Goodrich Chemical Co., Rose Bldg., Cleveland, plans to construct a pilot plant, including process building, laboratory, machine shop, etc. Bonfield & Cummings, 1900 Euclid Ave., Cleveland, Archts. Estimated cost $600,000.

O., Cleveland—Harshaw Chemical Co., 1945 East 97th St., plans to construct a 1 story, 30x102x103 ft. addition for the production of nickel sulfate at 1900 Harvard Ave. Estimated cost $290,000.

Pa., Erie—Hammermill Paper Co., East Lake Rd., plans to construct a 2 story factory and boiler house. Estimated cost $200,000.

Pa., Jeannette—Victory Glass Co., Inc., plans to construct a 1 story, 88x116 ft. with 35 ft. lean-to furnace building and a 35x76 ft. batch plant. Arthur W. Schmid, Investment Bldg., Pittsburgh, Engr.

Pa., Meadville—American Viscose Co., Marcus Hook, is having plans prepared for a plant for the manufacture of rayon yarn. John P. G. Heill, c/o owner, Archt.

Pa., Myerstown—Whitmoyer Laboratories, Inc., plans to construct additions to its laboratories. Estimated cost $100,000.

Tex., Austin—Sinclair Refining Co., Ship Channel, Corpus Christi, plans to construct a gasoline products bulk plant and loading station. Estimated cost $45,000.

Tex., Brownsville—Mexican Petroleum Administration, Mexico City, Mex., plans the construction of a refinery here for the manufacture of gasoline and other derivatives. Estimated cost $1,000,000.

Tex., Dallas—Carpenter Paper Co., 1621 Wall St., plans to construct a 1 story warehouse. Christensen & Christensen, 1327 Wood St., Archts. Estimated cost $40,000.

Tex., Rio Grande—Continental Oil Co., Houston and Rio Grande, plans to construct a new recycling plant. Estimated cost $250,000.

Tex., San Antonio—Sinclair Refining Co., Ship Channel, Corpus Christi, plans to construct a gasoline products bulk plant and loading station. Estimated cost $45,000.

Tex., Victoria—Sinclair Refining Co., Ship Channel, Corpus Christi, plans to construct a gasoline products bulk plant and loading station. Estimated cost $40,000.

Wash., Camas—Crown Zellerbach Corp., White Bldg., Seattle 1, plans alterations and additions to its paper plant. Estimated cost $46,944.

Alta., Hillspring—Alberta Cement Co., Ltd., Cardston, Alta., plans to construct a cement plant. Estimated cost $100,000.

Ont., Port Arthur—Provincial Paper, Ltd., plans to construct additional plant buildings and install new equipment. Estimated cost $75,000.

Ont., Toronto—Canada Plastic Coatings, Ltd., 26 West Adelaide St., plans to construct a factory.

Ont., Toronto—Kay Bros. Drug Co., Ltd., c/o W. G. Robertson, 257 Blythewood Rd., plans to construct a chemical and pharmaceutical products plant. Estimated cost $40,000.

Que., Montreal East—Gypsum Lime & Alabastine Canada, Ltd., plans to modernize its plant. Estimated cost $150,000.

CONTRACTS AWARDED

Ala., Birmingham—Barrett Div. of Allied Chemical & Dye Corp., 1327 Erie St., has awarded the contract for rebuilding its coal tar products plant recently destroyed by fire to Rust Engineering Co., Liberty Life Bldg., at $120,000.

Calif., San Francisco—Coffin-Redington Co., 301 Folsom St., has awarded the contract for a wholesale drug and manufacturing building, also warehouse, to Cahill Bros., 206 Sansome St., at $83,800.

Conn., Naugatuck—Naugatuck Glass Co., Bridge St., has awarded the contract for a 1 story factory to W. J. Megin, Inc., 51 Elm St. Estimated cost $40,000.

N. Y., Falconer—Falconer Plate Glass Corp., Richard Turner, Pres. and Mgr., has awarded the contract for a 1 story, 50x90 ft. addition to its plant to Scalise Bros., Merlin Ave., Jamestown. Estimated cost including equipment $40,000.

Pa., Eldred—National Powder Co. has awarded the contract for a 1 story, 30x60 ft. acid recovery plant to International Chimney Corp., 361 Delaware Ave., Buffalo, N. Y. Estimated cost $40,000.

Tenn., Kingsport—U. S. Engineer, Post Office Bldg., Savannah, Ga., has awarded the contract for the construction of a sodium acetate manufacturing plant. Bldg. No. B8B, Plant "B", Holston Ordnance Works, to Coe-Stinson Construction Co., 508 Builders Bldg., Charlotte, N. C., at $61,976.

Tex., Big Sandy—Rogers Lacy, Longview, will construct an asphalt plant here. Work will be done by owner. Estimated cost $500,000.

Tex., Carthage—United Gas Pipe Line Co., 1525 Fairfield Ave., will construct a dehydration plant unit with own forces. Estimated cost $350,000.

Tex., Texas City—Tin Processing Corp., has awarded the contract for the construction of a plant unit to Tellepsen Construction Co., 3900 Clay St., Houston, at $91,642.

Vt., St. Albans—National Carbon Co., Inc., P. O. Box 6087, Cleveland, O., has awarded the contract for a 1 story, 160x500 ft. factory on U. S. Route 7, to Gillmore-Carmichael-Olson Co., P. O. Box 110, Cleveland. Estimated cost $300,000.

Ont., Kitchener—Dominion Rubber Co., Ltd., 145 Strange St., has awarded the contract for the construction of a plant building to Dunker Construction, Ltd., 251 King St. Estimated cost $70,000.

Que., St. Laurent—Industrial Glass Works Co., Ltd., 57 Ouimet St., has awarded the contract for the construction of a factory to Alfred Gravet, 4309 Delaroche St., Montreal. Estimated cost $250,000.